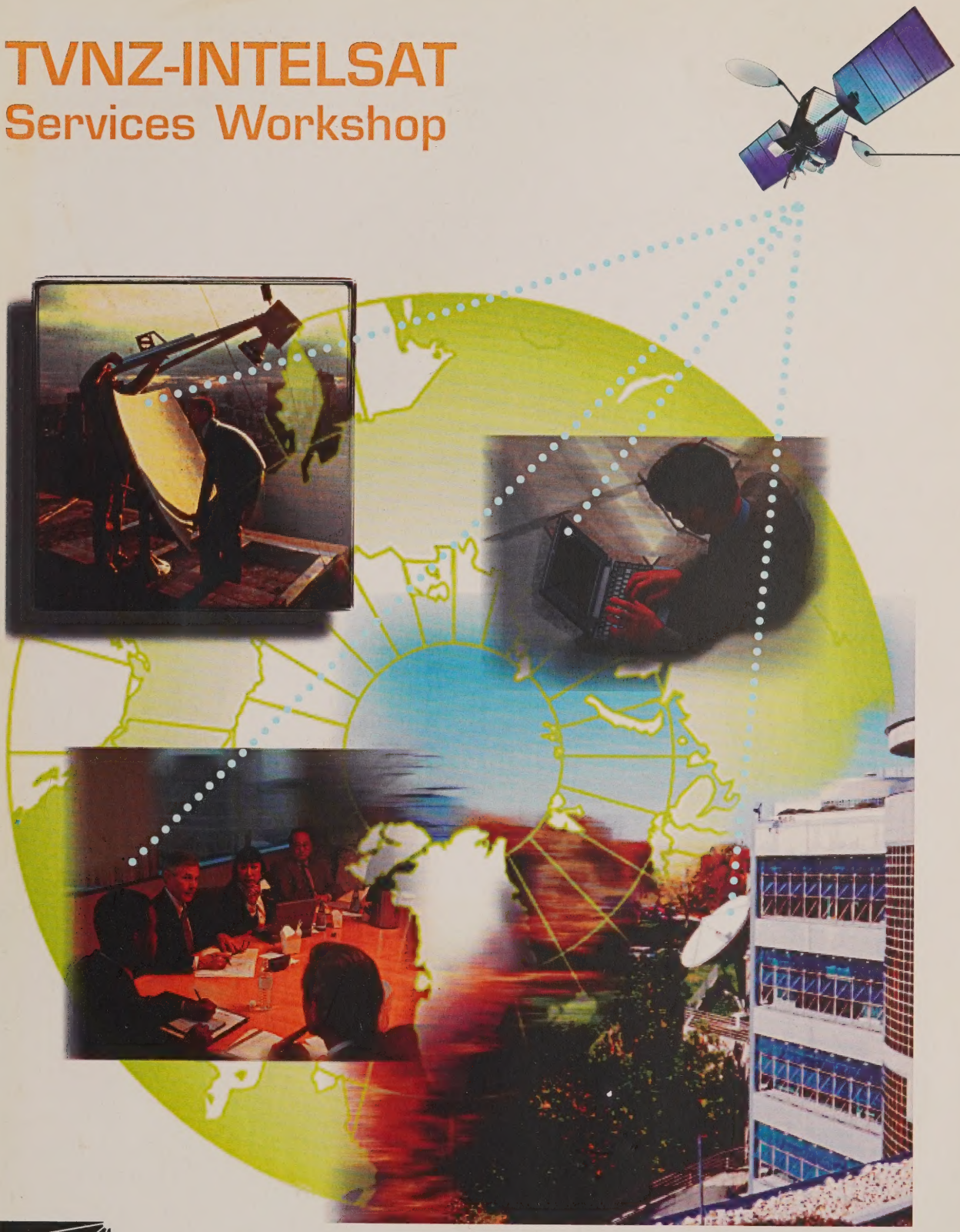
TVNZ-INTELSAT
Services Workshop



Auckland, New Zealand
8 - 9 August 2000

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https://archive.org/details/tvnzintelsatserv00unse

Satellite Deployment Plan & Future Capacity Options

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INTELSAT Serves the World

Member Country Non-Member User

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INTELSAT's Network Today

Indian Ocean Region	Atlantic Ocean Region		Pacific Ocean Region
60°E	304.5°E	330.5°E	174°E
62°E	307°E	332.5°E	177°E
64°E	310°E	335.5°E	180°E
66°E	325.5°E	342°E	
	328.5°E	359°E	

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INTELSAT's Planned Network

22 SATELLITES IN ORBIT!

Indian Ocean Region	Atlantic Ocean Region		Asia- Pacific / Pacific Ocean Region	
33°E	304.5°E	330.5°E	85°E	174°E
60°E	307°E	332.5°E	157°E	176°E
62°E	310°E	335.5°E		178°E
64°E	325.5°E	340.5°E		180°E
66°E	328.5°E	342°E		
		359°E		

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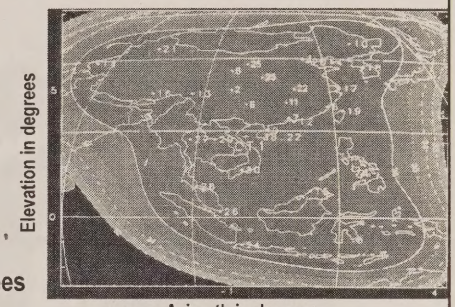
Introducing APR-2 @ 110.5°E

- Partnership with SinoSat for Asian landmass connectivity
- Offers 6 x 36 MHz in C-band
- New leases and GRs only
- Leases of 9 MHz +
- 6 months – 5 year terms
- No amendments
- No continuity or restoration guarantees
- May transfer to INTELSAT satellites



For Sale Now

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Investing for Growth

- 9 new satellites on order
- Operations at 22 orbital locations: 2002
- Advanced plans for new broadband system

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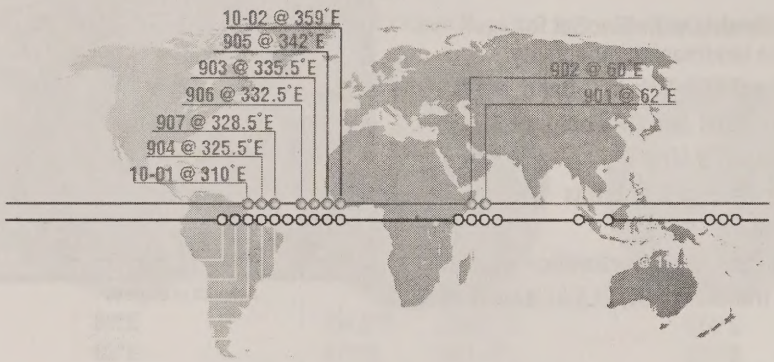
Satellites in Orbit & Under Procurement



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Spacecraft Procurements

- Approved satellite procurement:
  - INTELSAT 901 - 905 in 1997 & 1998
  - INTELSAT 906 & 907 Dec. 1999
  - 10-01 Jan. 2000
  - 10-02 Feb. 2000
- Total spacecraft under procurement:
  - Seven INTELSAT IXs
  - Two INTELSAT X's

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9 New Spacecraft by 2003

2001	May	IS-901
	July	IS-902
	Sep.	IS-903
	Dec.	IS-904
2002	Feb.	IS-905
	June	IS-906
	Oct.	IS-907
2003	May	IS-10-01
	Jul.	IS-10-02

US$2.4B investment

Net increase of 386 x 36 MHz units

Create 6 new roles

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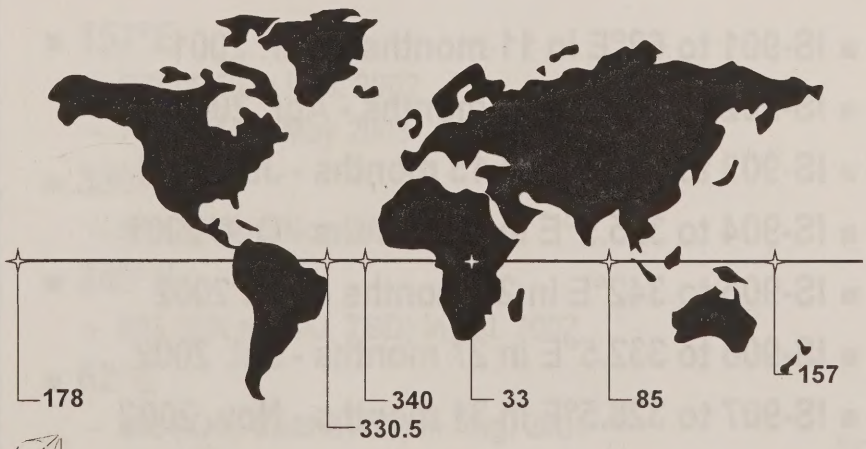
New Orbital Roles



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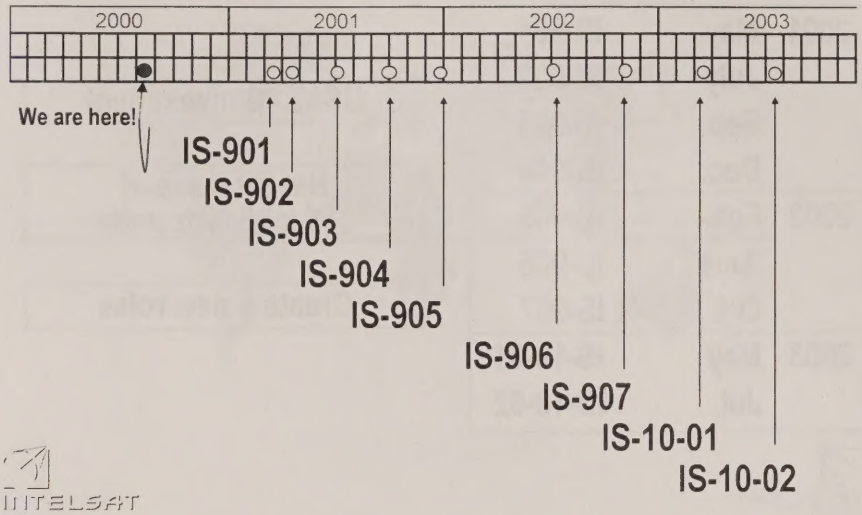
Our New Fleet In-Service 9 s/c in 40 months



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Deployment of Our New Fleet

- IS-901 to 62°E in 11 months - Mar. 2001
- IS-902 to 60°E in 12 months - Apr. 2001
- IS-903 to 335.5°E in 15 months - Jul. 2001
- IS-904 to 325.5°E in 18 months - Oct. 2001
- IS-905 to 342°E in 21 months - Jan. 2002
- IS-906 to 332.5°E in 27 months - Jul. 2002
- IS-907 to 328.5°E in 31 months - Nov. 2002

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Redeployment of VIs and VIIs to New Location

- 178°E
  - 602 (IOO) in May 2001
  - 705 (S/K) in Feb. 2002
- 33°E
  - 604 (IOO) in May 2001
  - a VII (S/K) in late 2003
- 85°E
  - 601 (IOO) in Nov. 2001

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Redeployment of VIs, VIIs and VIII to New Location

- 157°E
  - 602 (IOO) in Feb. 2002
  - 709 (S/K) in May 2003
- 330.5°E
  - 801 (S/K) in Nov. 2002
- 340°E
  - 605 (S/K or IOO, TBD) in Jul. 2002
- 62°E
  - 603 (IOO, Cold STBY) in Aug. 2001

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Sparing in IS-IX Era

- 906 (Gen) at 332.5°E:
  - 307°E, 310°E, 325.5°E, 328.5°E, 335.5°E, 342°E, 359°E
  - 60°E, 62°E, 64°E, 66°E
- 701 at 180°E:
  - 174°E, 176°E, 178°E
- Station-kept roles not restored with sparing spacecraft
  - 304.5°E, 33°E, 83°E(APR1) and 157°E
- TBD
  - 330.5°E

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Implement 2 Deg Spacing in POR

- Phase 1: Relocate 702 to 176°E in Oct. 2000
  - Being coordinated with customers, analysis of ASI and necessary arrangements
  - Fast Relocation within 4 days
- Phase 2: Redeploy 602 to 178°E in May 2001
  - Establish New IOO Roles
- Phase 3: Redeploy 705 to 178°E in Feb. 2002
  - Establish New S/K Role

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Non-preemptible Customers on 701 @ 180°E

- Regional Spare in POR
- Non-preemptible Lease Holders have been
  - Requested to relocate their services to 178°E following deployment of 705 at 178°E
  - Guaranteed to have same frequency & connectivity on 705 at 178°E

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INTELSAT Indian Ocean Region (IOR)

- IOR - 60°E to 66°E
  - 4 Satellites
  - 2 VIs, 1 VII, 1 VIII
- Two INTELSAT IXs on order
  - Replacement of spacecraft at:
    - 60°E & 62°E
  - Redeployment of replaced VIs to:
    - 33°E IOR & 178°E POR

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CURRENT DEPLOYMENT IS-602 @ 62°E

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Future Deployment IS-901 @ 62°E

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Current Deployment IS-604 @ 60°E

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Future Deployment IS-902 @ 60°E

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Current Deployment IS-804 @ 64°E

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Current Deployment IS-704 @ 66°E

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Future Deployment IS-701@33°E

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INTELSAT Asia Pacific Region (APR)

- APR - 83°E
  - Station-kept capacity at 83°E (APR-1)
- New roles - 85°E & 157°E
  - to be established with spacecraft released from other roles:
    - 85°E - IOO VI
    - 157°E - IOO VI then S/K VII

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Current Capacity APR-1 @ 83°E

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Future Ku-band Deployment IS-VI @ 85°E

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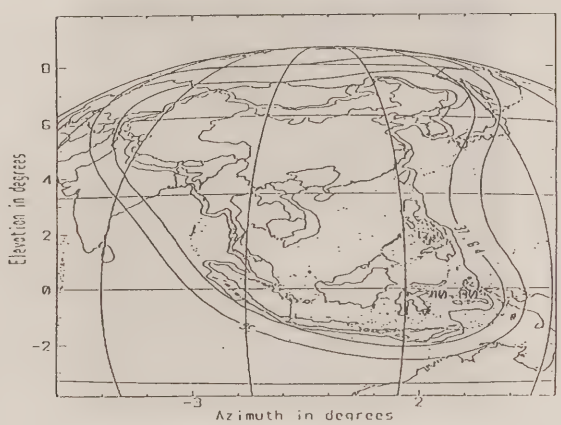
Current Capacity APR-2 @ 110.5°E



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INTELSAT Pacific Ocean Region (POR)

- POR - 174°E to 180°E
  - 3 Satellites
  - 1 VIII and 2 VII's
  - Introduction of 2 degree spacing:
    - Redeployment of VII from 177°E to 176°E
    - Create new role at 178°E with IOO VI then S/K VII
  - INTELSAT spacecraft in the POR at: 174°E, 176°E, 178°E & 180°E by mid-2001

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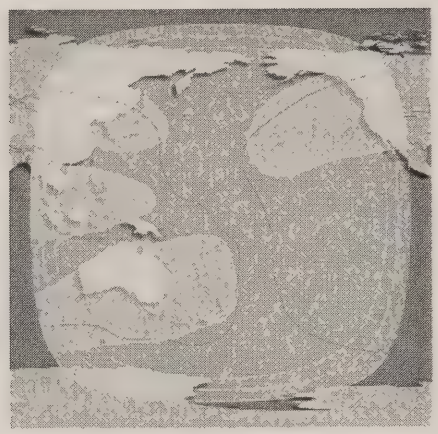
Current Deployment IS-802 @ 174°E



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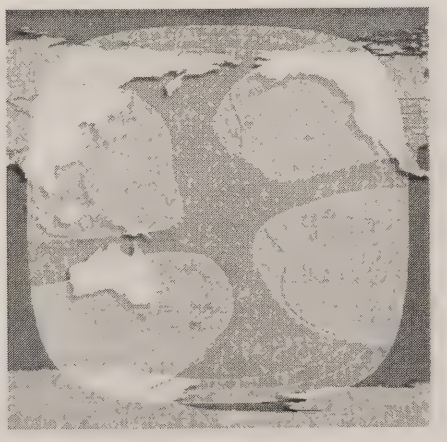
Current Deployment IS-702 @ 177°E



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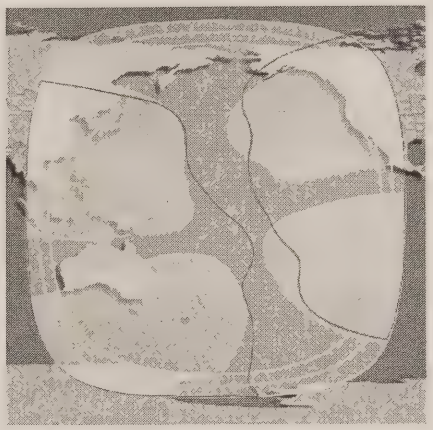
Current Deployment IS-701 @ 180°E



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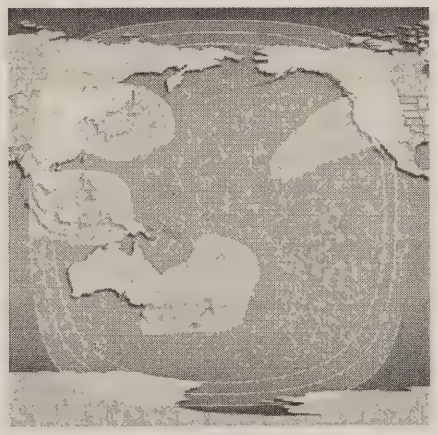
Future Deployment (IOO) IS-602 @ 178°E



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Future Deployment IS-705 @ 178°E

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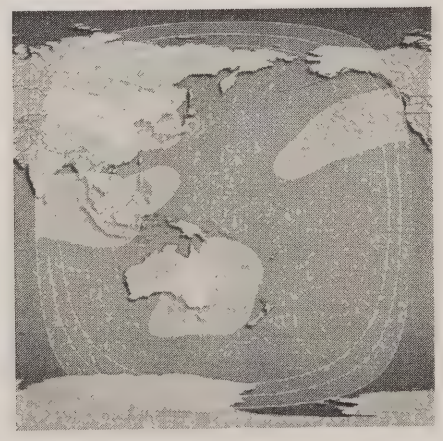
Future Deployment (IOO) IS-602 @ 157°E



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Future Deployment IS-709 @ 157°E

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Conclusion

- 17 satellites in-orbit today and a total of 26 by 2003
- Global connectivity for world-wide reach
- Multi-billion dollar INTELSAT IX and X programs for your future needs
- New innovative procurements and strategic arrangements being considered
- More capacity to serve you!

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INTELSAT's New Lease Reservation Policy & Service Ordering Procedures

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Customer Service

- Customer support & inquiries
- Sales coordination
- Capacity availability
- Service resolutions/Customer concerns
- Direct Access/New customers

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What are Lease Services?

- A lease is a do-it-yourself option for customers
- INTELSAT provides the bandwidth and power, the customer then utilizes the capacity in accordance to its specific requirements
- There are limits: a customer cannot interfere with other services on the satellite or use capacity exceeding what has been reserved

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Where are Leases Offered?

- Leases are offered on all INTELSAT satellites with the exception of capacity dedicated for carrier services
- Leases may be placed on all transponder types: global, hemi, zone, Ku-band spot, C-band spot

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First Refusal Reservations

- For customers who believe they need the capacity but are not 100% certain
- FRRs may be made up to 6 months in advance on the start date
- Fee required if start date is within 3 months: 2.5% of the per annum tariff (minimum of $12,500)
- Fee required if start date is 3 - 6 months: 5% of the per annum tariff (minimum of $25,000)

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First Refusal Reservations

- FRR may be renewed but:
  - Original fee is forfeited
  - New fee is required
  - Conditional upon no other FRRs in queue
- Fee is reimbursed if FRR is upgraded to GR by start of service date, otherwise the fee is forfeited

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Guaranteed Reservations

- For customers who are certain they need the capacity
- Even if the customer subsequently decides the capacity is not needed, the charges will still apply
- GR Lead Time
  - GRs for leases of 3 years or longer may be made up to 1 year prior to the start date
  - GRs for leases of less than 3 years may be made up to 6 months prior to the start date

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Guaranteed Reservations

- No fee required (though collateral may be required)
- When upgrading from FRR to GR, the start date can be delayed by 6 or 12 months from the date of upgrade (depending on lease duration)
- A GR request may challenge another customer's FRR

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Lease Options: Duration

- Long-Term Leases: 1 year to 15 years
- Short-Term Leases: 1 day to 1 year
- Occasional Use Leases: 10 minutes to 1 day
- Large number of tariff tiers: for example for long-term leases, different rates are charged for durations of 1, 2, 3, 5, 7, 10 and 15 years

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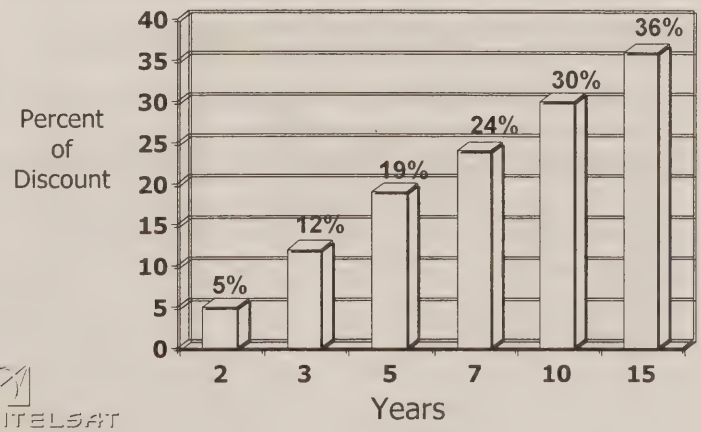
Discounts for Long-Term Leases

Discounts Versus 1 Year Lease Rates:



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Lease Options: Bandwidth

- Available for 0.1 MHz to a full transponder
- Numerous tariff tiers (0.1, 1, 5, 9, 18, 24, 36, 72 MHz)
- Customer charged based on the power equivalent bandwidth
- If customer wants 18 MHz of bandwidth but the power associated with 36 MHz, the customer would pay the 36 MHz rate

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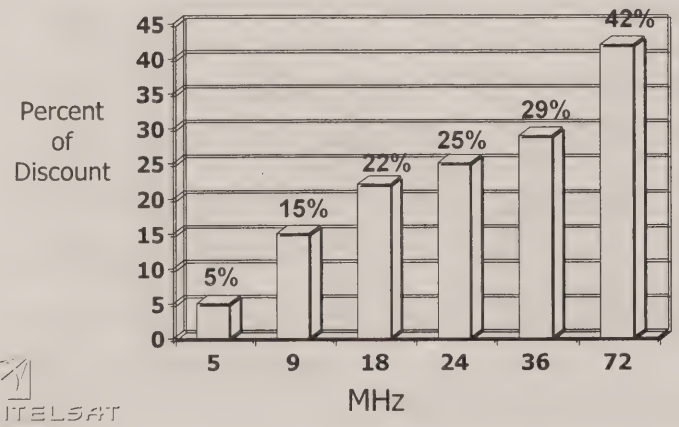
Discounts for Larger Lease Sizes

Discounts Versus 1 MHz Lease Rates:



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Preemptibility Options

- Non-Preemptible Leases have the highest priority for continuity and restoration in the event of satellite or transponder failure
- Preemptible Leases could be preempted in the event of failure in order to restore non-preemptible leases or higher priority preemptible services

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Lease Options: Standard and Premium Transponders

- Certain transponders with significantly higher power than other transponders are charged at "premium" rates
- All other transponders are charged at "standard" rates

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In Summary...

- Pricing Factors
  - Bandwidth
  - Start of Service
  - Duration
  - Preemptibility
  - Downlink Beam
  - Standard and Premium Transponders
  - Various Discounts

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Order Submission

- Customer must complete the 2 page Request For Service form, available on public website
- Faxes and emails also acceptable as long as all 6 parameters are outlined.

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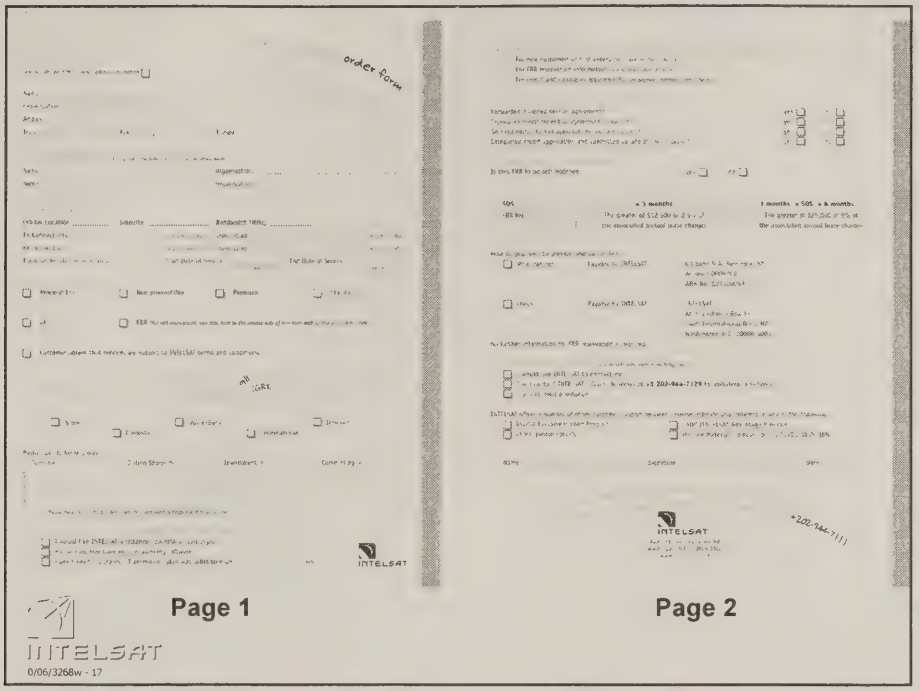
order form
INTELSAT
Page 1
Page 2
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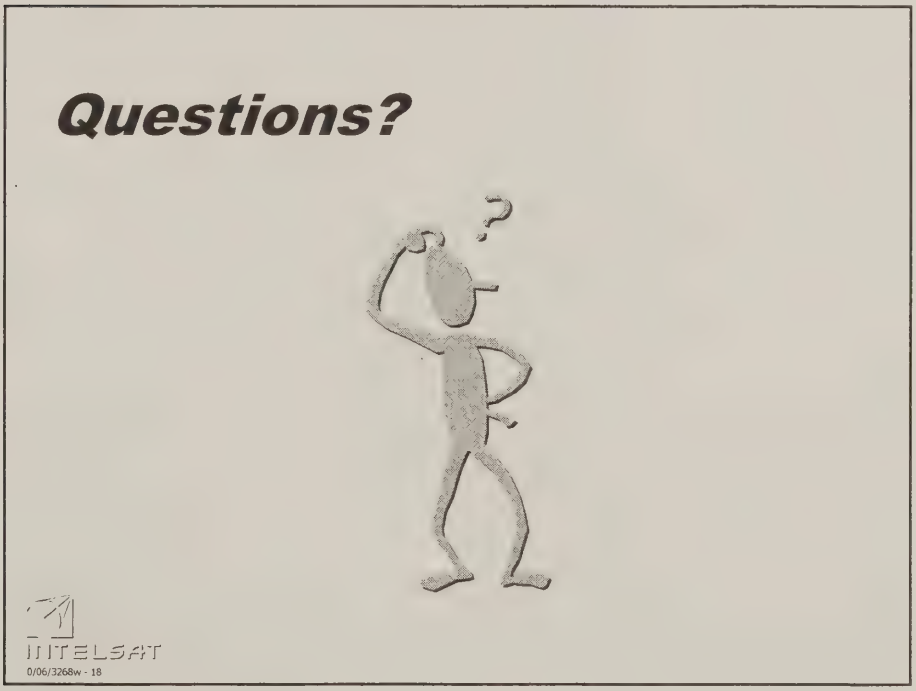
Questions?
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Application Support & Training

INTELSAT Advantage Program

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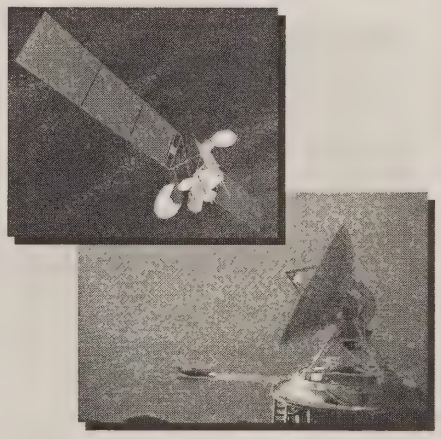
INTELSAT Advantage Program: Mission

- Provides unparalleled technical consultancy, training and other assistance
- Assists in cost effectively introducing new services



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INTELSAT Advantage Program: Only from INTELSAT

- Helps to develop and maximize new, advanced satellite services and applications

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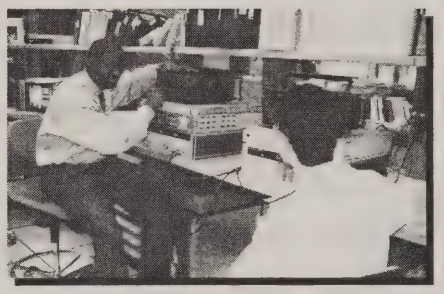
INTELSAT Advantage Program: Only from INTELSAT

- Available in English, French and Spanish
- Not available from other operators (satellite or cable)



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Advantage #1:
Consultancy from Professionals

- INTELSAT Assistance and Development Program (IADP) offers assistance with
  - Technical and Business case feasibility studies
  - Business analysis and network planning
  - Network design, equipment configuration
  - Program management
  - Implementation of new services: BVSAT, DAMA, LC-TDMA, Corporate Networks, Universal Access Services, Digital TV (O.U.TV and TV distribution)

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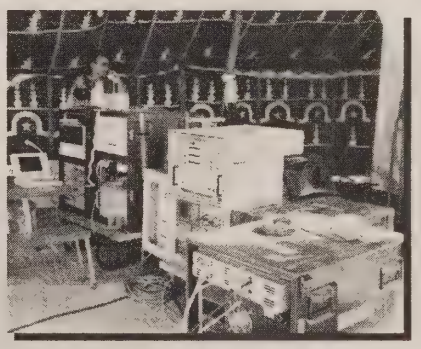
Advantage #1: Consultancy from Professionals (con't)

- Specification and Proposal Evaluation:
  - New Earth stations
- On-site Visits:
  - Testing to commission traffic
  - Equipment acceptance testing
  - Refurbishment of facilities



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Advantage #2:
Training from Experts

- The INTELSAT Training Program is a multifaceted program offering training to customers at every level
- Technical Seminars offered:
  - Digital Services and Technology via INTELSAT
  - Emerging Services and Technologies (Internet, Frame Relay, and ATM)
  - Planning and Implementation of International Digital Services

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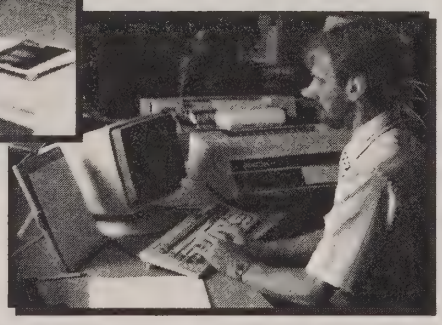
Advantage #2:
Training from Experts (con't)

- Technical Courses:
  - Earth Station Technology
  - Digital Technology



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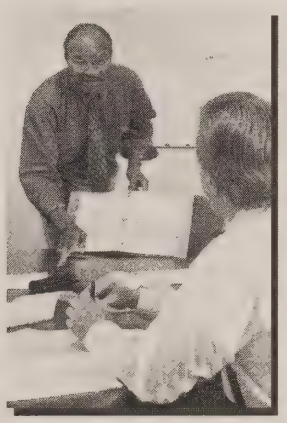
Advantage #2:
Training from Experts (con't)

- Practical Training for Signatories:
  - On-the-Job Training Program
  - Earth Station Practical Training
  - Hands-on on DAMA and TCP/IP over satellite



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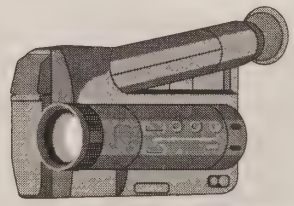
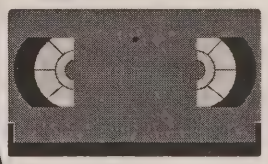
Advantage #2:
Training from Experts (con't)

- Training Resources:
  - Handbooks
  - Audio Cassette
  - Video Tapes





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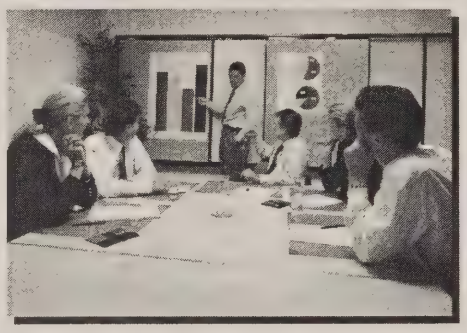
Advantage #3:
Little or No Cost

- Consultation at no cost
- Training:
  - No fees for attendance
  - Attendees pay own travel expenses
  - Training resources at no cost



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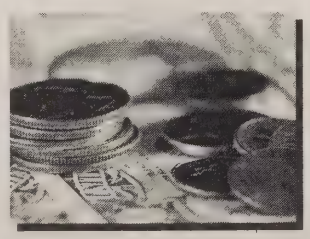
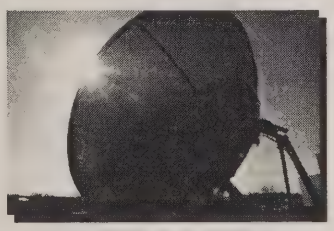
Advantage #4: Financial
Assistance for Signatories



- Facilitates procurement of digital equipment:
  - Advances of up to US$2 Million for 2 years



- Digital Equipment Loan Program:
  - Is only available to Signatories

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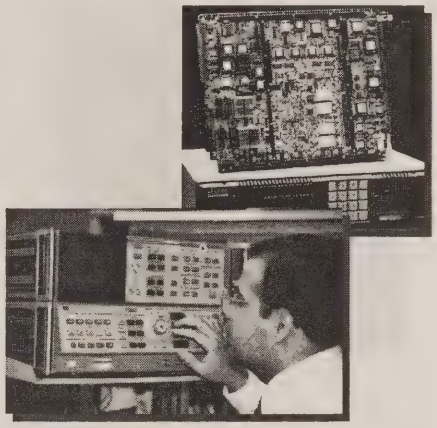
Advantage #4: Financial Assistance for Signatories (con't)

- Loans can get you started with:
  - Implementing new services
  - Thin Route-on-Demand
  - New Low Cost TDMA
  - IDR / DCME



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Advantage #4: Financial Assistance for Signatories (con't)

- User credits with INTELSAT:
  - Many users have credits held with INTELSAT
  - Can be used for procurement of equipment
  - Overcomes budget restraints or foreign currency problems
  - INTELSAT can make payments to suppliers from credits

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Put the Advantage Program to Work for You

- INTELSAT Users are facing:
  - Competitive challenges
  - Changing customer demands
  - Unfamiliar new technologies
  - Need to train staff
  - New Services

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INTELSAT Advantage Program

Recent Training for Asia - Pacific

- VSAT Networks: Nepal, Philippines, Singapore, Sri Lanka
- Video: Bhutan, India, Philippines
- Internet: China, French Polynesia, India, Mongolia, Philippines, PITA
- Rural: Fiji

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2000 Training/Seminars:
Upcoming Training and Seminars

- July
  - Emerging Services Seminar & Live Demo, Lome, Togo
  - Internet, VSAT, Corporate Networks & Rural Telephony, Taipei-Taiwan, Bangkok-Thailand , Bangalore-India
  - Direct Access Orientation, West Coast
- August
  - Internet, VSAT, Financial & Direct Access via INTELSAT, Mozambique
  - Internet, VSAT, Corporate Networks & Rural Telephony, Sydney-Australia, Auckland-New Zealand, Wellington-New Zealand
  - VSAT Training
  - Transmission Planning Training

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2000 Training/Seminars

- September
  - Emerging Services via INTELSAT, France
- October
  - Implementing IP Networks Over Satellites, Cuba
  - GORC
  - VSAT, Internet and Digital Video, Ocho Rios, Jamaica
- November
  - BVWG and IBF Conference, New York
  - Tarantula, Venue to be determined
- December
  - VSAT, Internet & Digital Video, Hong Kong

For updated information on seminars and training visit the IBN
- The INTELSAT BUSINESS NETWORK
at https://ibn.intelsat.int/events

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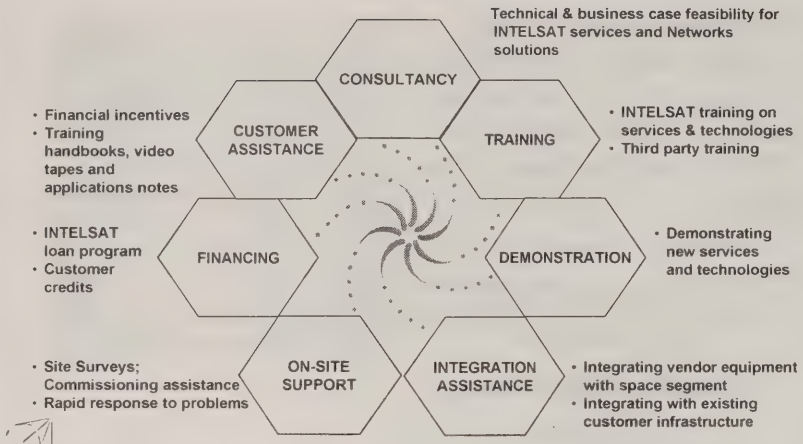
INTELSAT Advantage Program



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Thank You!

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Privatizing INTELSAT

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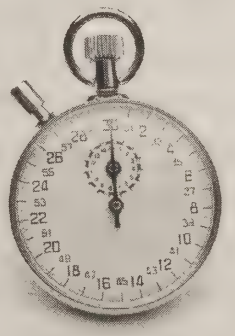
In 1999...

- Shareholders and member governments formally agreed INTELSAT should privatize
- Completion as early as April 2001



INTELSAT
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Why Privatize?

- Fast-paced requirements for
  - More specialized and value-added services
  - Greater broadband capacity
- Increased competition
  - Highly capitalized, agile, global satellite competitors
  - Expanding global fiber optic cable systems

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0/06/3268n - 3

Key Privatization Principles

- Create a strong, competitive company
- Level playing field
- Maximum flexibility
- Continuity of service for all customers
- Maintenance of global connectivity and coverage
- Maintenance of non-discriminatory access
- Protection of lifeline users and connectivities

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Recommendations to Assembly of Parties

- All assets to be transferred into fully private international holding company, Intelsat Ltd.
- Small, intergovernmental organization (IGO) will supervise the performance by the Company of core principles related to public service commitments
- IGO's duration is flexible and linked to the duration of Lifeline Connectivity Obligation

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How Does Privatization Affect You?

❶ Business relations

❷ Service contracts

- Market access
- Transfer of contracts
- Lifeline connectivity protection

❸ Investment share

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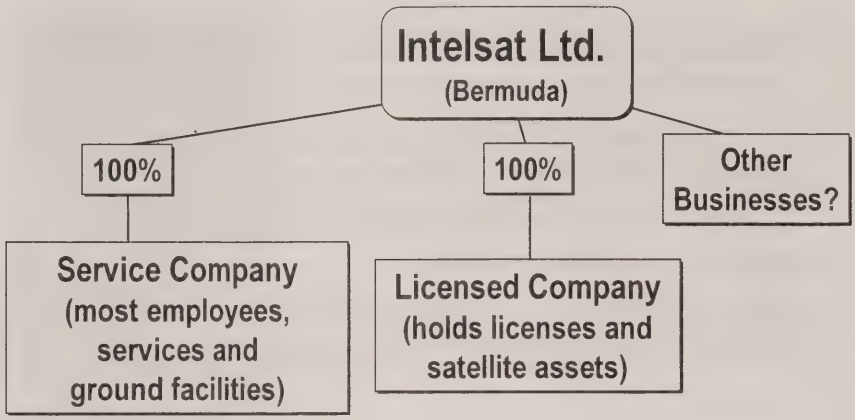
Intelsat Ltd.



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Business Relations

- Service company of private "Intelsat" planned to remain in Washington area
- Most staff to remain here, plus
  - Increased customer service and marketing
  - Increased presence in the regions

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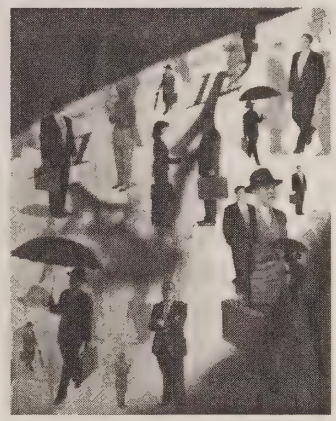
Business Relations

- Current customer base is the foundation of our future distribution network and growth
- Privatization will bring new opportunities for collaboration and co-marketing



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Service Contracts:
Market Access

- Securing of landing rights for continuity of services by private Intelsat is critically important to privatization
- INTELSAT is working with regulators and Signatories in all countries
- Questions:

Mr. Doug May
Manager International Affairs
douglas.may@intelsat.int
Tel: +1 202 295 3257
Fax: +1 202 295 3278

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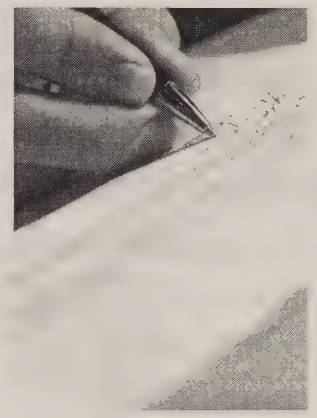
Service Contracts:
Transfer

- All existing commitments will be transferred to – and honored by – private Intelsat
- Majority of terms and conditions of existing contracts will remain unchanged



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Service Contracts:
Transfer

- Services will transfer with the signing of the Novation Agreement
- Preparations have begun
  - Review of channel and carrier allotments and associated commitments began in April
  - Periodic review will continue through next April

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Service Contracts:
Lifeline Connectivity Protection

- Lifeline Connectivity Obligation (LCO) of private Intelsat will offer price and connectivity protections for eligible commitments
- Customers in countries that meet the criteria are pre-qualified for LCO protections
  - "Low Income" countries as defined by World Bank; or
  - Countries with less than 3.0 teledensity as defined by ITU
- Correspondents also eligible for protection

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Service Contracts:
Lifeline Connectivity Protection

- Other customers may petition for protection of commitments where there is no cost effective alternative provider of an equivalent service
- Petition deadline 1 August 2000
- Questions:

Mr. Bill Henderson
Manager Restructuring Affairs
william.henderson@intelsat.int
Tel: +1 202.944.7406
Fax: +1 202.

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Investment Share

- Final INTELSAT share determination exercise expected on 1 March 2001
- All investors in INTELSAT will then receive proportional shares in Intelsat Ltd. on the date of transfer of assets
- Initial public offering (IPO) of private Intelsat shares expected 2002

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GOAL:

Seamless Transition

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Recap: INTELSAT Privatization

More commercial freedom

More customer focus

Better public service

Better long-term value for all

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Shared Vision, Global Reach...

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INTELSAT Services and Privatization

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Today's Agenda

- INTELSAT at Glance
- Business Lines
- Why INTELSAT ?
- Regional Highlights
- INTELSAT Privatization
- Conclusion

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Current Business

- 700+ customers in 215 countries and territories
- Premier PSTN and Internet backbone capacity provider
- Premium quality provider – availability of >99.996%
- VSAT networks: Europe, Latin America, Africa, Middle East, Asia-Pacific
- Worldwide Video Distribution Platform of 200 x 36 MHz channels
- Dedicated occasional use video capacity

INTELSAT

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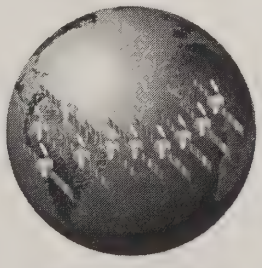
INTELSAT's Network Today

17 + 2 SATELLITES IN ORBIT!

Atlantic Ocean Region



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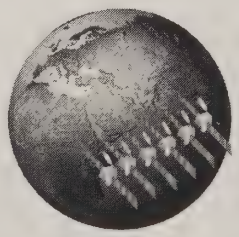
Indian Ocean Region



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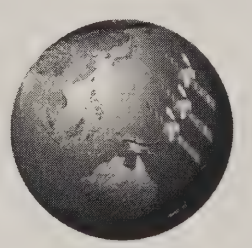
Pacific Ocean Region



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INTELSAT

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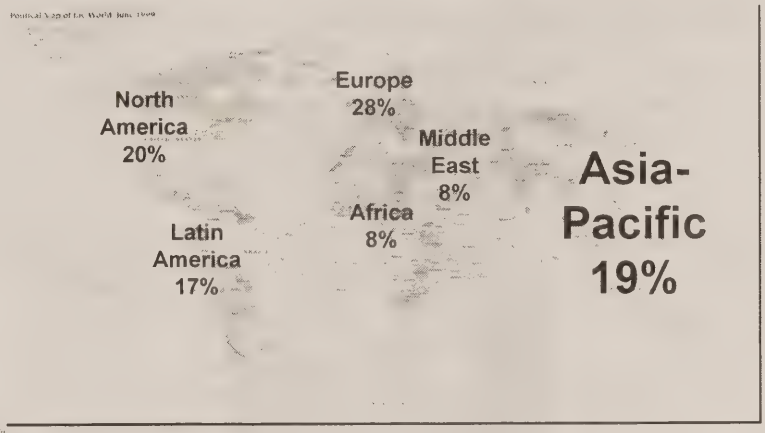
Revenue by Region:
1999 Total Revenue = $977 Million



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Top 6 Customers in 2000

- Comsat World Systems-USA
- Videsh Sanchar Nigam LTD, India
- British Telecommunications LTD-UK
- Telenor Satellite Services, Norway
- Teleglobe, Canada
- Embratel, Brazil

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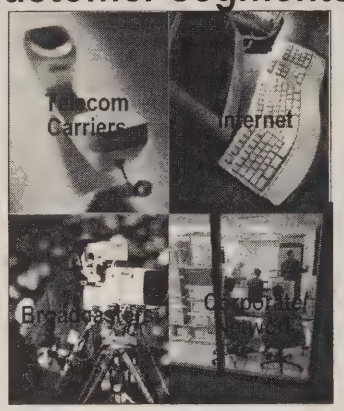
Business Lines

Offering global services to four major customer segments



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Internet: Fastest Growing Business in the Region

Internet traffic to Asia increased 300% in 1999!

- INTELSAT system is currently carrying approximately 1 Gbit/s of IP traffic to/from Asia
- Asia & the Pacific = 17 % of all Internet users (approximately 43 million people)
- 80 % of countries in Asia use INTELSAT for connections to the Internet backbone
- Australia, Greater China and India are the fastest growing Internet markets

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High-Speed Internet Links to Asia

North America - Australia:	Duplex 155 Mbit/s
North America - Australia:	Hybrid 4 x45 Mbit/s
North America - China:	Asymmetric 2 x 45:8 Mbit/s + 1 x 45 Mbit/s Duplex
North America - Hong Kong:	Five Hybrid 45 Mbit/s
North America - Korea	Hybrid 2 x 45 Mbit/s
North America - Malaysia:	Duplex 45 Mbit/s
North America - New Zealand:	Asymmetric 3 x 45:6 Mbit/s
North America - Singapore:	Hybrid 45 Mbit/s
North America - Taipei:	Hybrid 2 x 45 Mbit/s
North America - Thailand:	Asymmetric 4:2 Mbit/s
North America - UK – India:	4 x 34 Mbit/s
Pacific Islands:	Aggregate Total: 5 Mbit/s
Singapore - UK:	9 Mbit/s
Thailand - UK:	36 Mbit/s

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Changing Customer Base

- Deregulation... More Markets Opening Up
- More Customers are Accessing INTELSAT Directly
- INTERNET & Business Network Applications are Driving Growth
- New Customers = New Ways of Doing Business

INTELSAT

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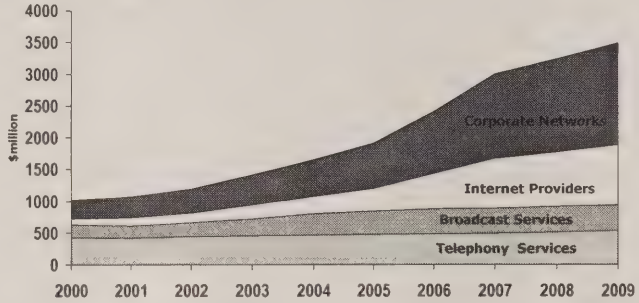
Revenue by Services

- Projected annual revenue growth of 14% - Internet and corporate network services as key drivers for growth
- Revenues for Privatized INTELSAT:
  A Total of $20B thru 2009



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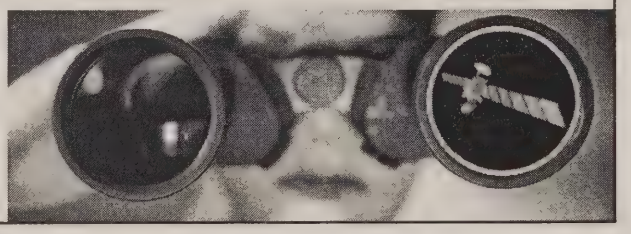
Growth Strategy

- Demand increasing rapidly
- 9 new satellites for growth
- Broadband system planned
- Four specific initiatives underway to exploit growth opportunities



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Four Growth Initiatives

- Value-added services for Internet Network Providers
- Managed network solutions for Corporate Network Providers
- Complete solutions for Broadcasters' video contribution and distribution needs
- Rural telephony and broadband local access for Carriers

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Global Connectivity

- International/Regional
  - Telephony
  - Internet
  - Video
  - Business VSATs
- Domestic
  - Rural Telecommunications

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INTELSAT Offers a Variety of Options

- C- and Ku-Band
- Diversification of Traffic
- Global Coverage
- Global Connectivity
- User Communities
- Tailored Solutions

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INTELSAT Capacity Offers Security

- Sparing and Restoration Options
  - Resilience within a spacecraft
    - Redundant Units
  - Resilience within the INTELSAT System
    - In-Orbit Spare Spacecraft
- Proven Reliability
  - 99.998% transponder availability

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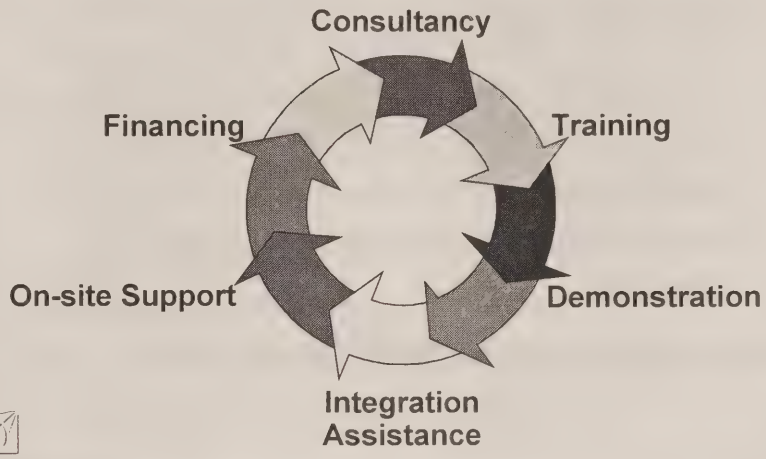
Advantage Program



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Privatizing INTELSAT

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Privatizing INTELSAT

- Privatization allowing INTELSAT
  - To meet new competitive challenges and your requirements for increased capacity
  - While continuing to ensure global satellite connectivity and coverage for users in all countries
- Completion as early as April 2001

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INTELSAT Privatization Timetable

Final endorsement of privatization
4th Quarter - 2000

↓

Incorporation as early as
1 April 2001

↓

IPO targeted in late 2001 to 2002
timeframe

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Privatized Intelsat Business Plan

- Take INTELSAT from a $1B organization today to a $3.5B corporation by year 2009
- Focus on four major growth initiatives
  - Universal Access (rural telephony and data)
  - Internet
  - Global digital video
  - Corporate networks
- 14% CAGR growth profile relies on creation of a broadband satellite platform

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Achieving the Plan

- Changing organizational structure to address customer needs
- Growing capacity
- Adding new products and services
- Expanding Sales & Support
  - Regional Support Centers
  - Enhancing e-customer support

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Our New Spacecraft & Roles

- Total s/c under procurement
  - Seven INTELSAT IX's
  - Two INTELSAT X's
- New Roles
  - 110.5°E: APR-II now available

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Our New Spacecraft & Roles

- New Roles (cont.)
  - 178°E
    - 602(IOO) followed by 705(S/K) in Feb. 2002
  - 33°E
    - 604(IOO) followed by a VII(S/K) in late 2003
  - 85°E
    - 601(IOO) in Nov. 2001
  - 157°E
    - 602(IOO) in Feb. 2002 and 709(S/K) in May 2003

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9 New Spacecraft by 2003

2001	May	IS-901
	July	IS-902
	Sep.	IS-903
	Dec.	IS-904
2002	Feb.	IS-905
	June	IS-906
	Oct.	IS-907
2003	May	IS-10-01
	Jul.	IS-10-02

US$2.4B investment

Net increase of 386 x 36 MHz units

Create 5 new roles

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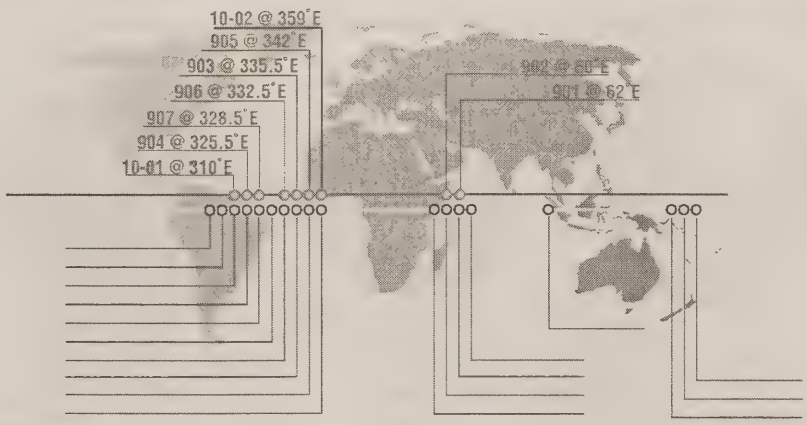
INTELSAT's Global System



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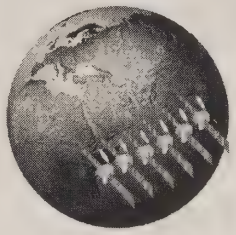
INTELSAT's Planned Network

22 + 2 SATELLITES IN ORBIT!

Indian Ocean Region



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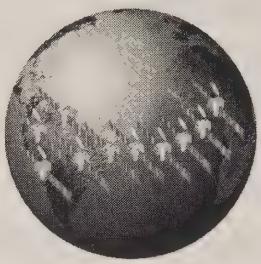
Atlantic Ocean Region



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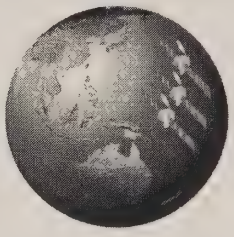
Asia- Pacific / Pacific Ocean Region



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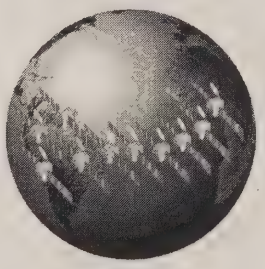
INTELSAT's Planned Network

22 + 2 SATELLITES IN ORBIT!

Atlantic Ocean Region



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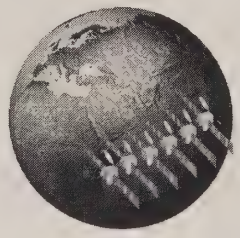
Indian Ocean Region



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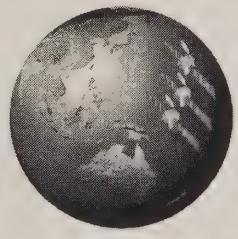
Asia- Pacific / Pacific Ocean Region



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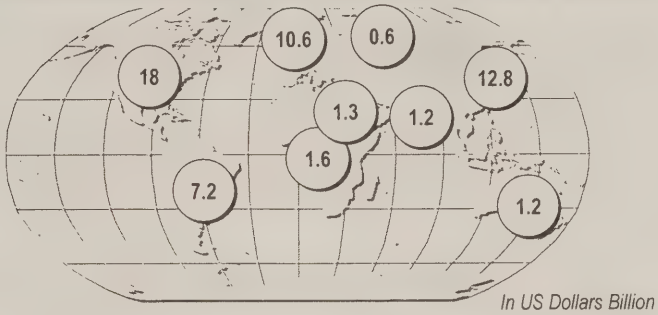
Broadband is the Future



- Market value US$55 B by 2015
- Market assessment underway with service providers
- Program in development

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Extending Our Reach

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Committed to the Future

- Meeting the mission of truly global satellite coverage
- Owns and operates a worldwide 17 satellite fleet
- Seven INTELSAT IX and two new spacecraft on order
  - First launch - end of 2000
  - Aggressive launch schedule with launches planned every 3-4 months
- $3B investment fully committed
- Interconnects hundreds of top service providers in 214 countries and territories

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Voice over IP (VoIP)

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VoIP

- What is it?
- Standards
- VoIP over Satellite
- Current Status

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VoIP, What is it?

- Packetized voice over IP network
- Low cost
- Efficient utilization of BW
- With other applications on IP platform (internet, video, data and etc.)
- Enjoying tremendous growth
- One-third of all voice traffic through IP in 2005??

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VoIP

- Voice over Internet
  - Best Effort
  - Toll Bypass
- Voice over IP
  - Managed Network
  - QOS guaranteed

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VoIP Possible Scenarios

- IP to IP
- IP to SCN*
- SCN to SCN
- SCN to IP

* Switched Circuit Network

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Application (Not just free internet calls)

- Internet voice telephony
- Intranet and enterprise network voice telephony
- Internet fax service
- Internet videoconferencing
- Multimedia Internet collaboration
- Internet call centers
- PBX interconnection

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Components

- End devices
- Gateways
- Gatekeepers
- MCUs
- Billing and Charging Systems

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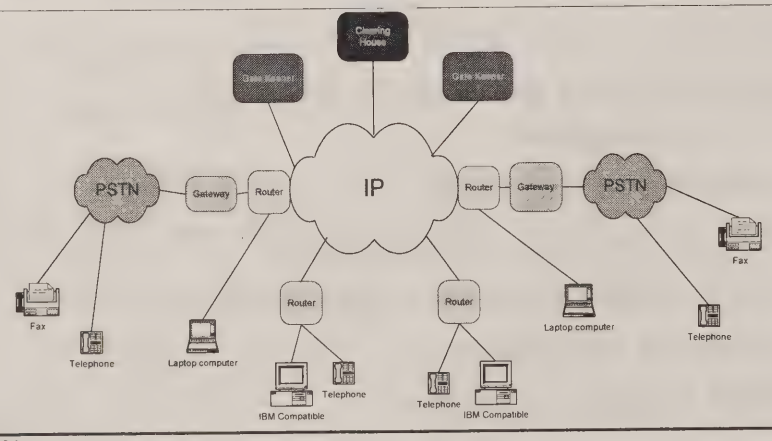
VoIP Components



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Standard Bodies

- IETF (avt)
- ITU-T (Study Group-16)
- IMTC (VoIP Forum)
- ETSI (TIPHON)

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IMTC (International Multimedia Teleconferencing Consortium)

- Promote interoperability of teleconferencing equipment
- VoIP Forum is one of its group
- VoIP Forum generated VoIP Implementation Agreement in 1998

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TIPHON (Telecommunications and Internet Protocol Harmonization Over Networks)

- Requirements for service interoperability
- Reference configurations and functional models, including position of gateway functions between IP based networks and PSTN and interfaces at these gateways
- Call control procedures, information flows and protocols

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TIPHON (con't)

- Address translation between E.164 and IPv4/v6 addresses
- Technical aspects of charging / billing
- Technical aspects of security
- End-to-end quality of service aspects, including transcoding and echo-cancellation
  - The work will be based on existing specifications, e.g. relevant parts of E.164, Ipv4/v6 and H.323

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H.323 Recommendation

- Umbrella recommendation from ITU
- Packet based multimedia communications with no guaranteed QoS
- Glue to make a telephony connection

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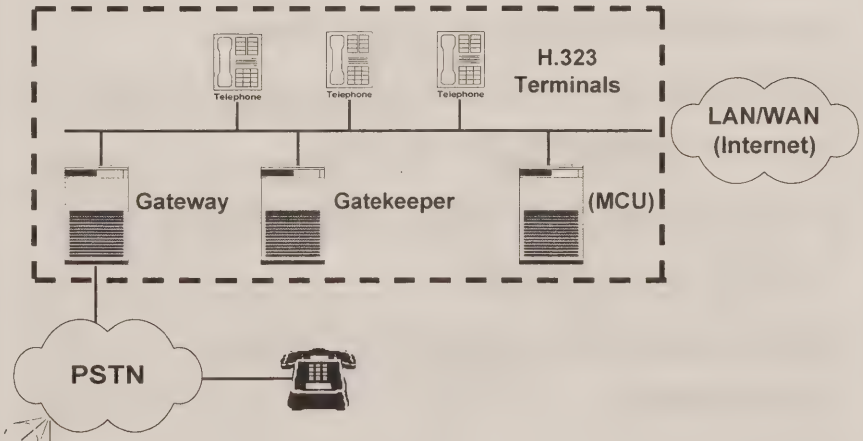
Components of H.323



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H.323 Terminal

- Audio Codecs / RTP / RTCP
- System control
  - H.245 and H.225 (capabilities / media control)
  - Q.931 (call setup procedure)
  - RAS gatekeeper interface
    - Terminal registration, call admission and call status

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VoIP Gateway

- Provide interoperability between different telecommunications systems (for example PSTN - H.323)
- Voice codec and echo cancellation (PSTN connection)
- Call setup / clearing at PSTN and IP domain

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VoIP Gatekeeper

- Network management
- Controls all registered devices
- Address translation
  - E.164 to IP address
- Call admission and authorization
- Billing and accounting

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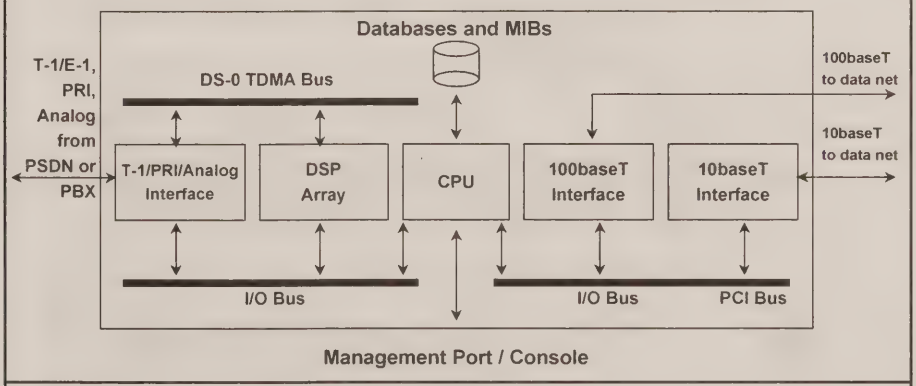
Typical Voice over IP Server



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Voice Codecs

Name	Rate	Delay	MOS
▪ G.711	64 kbit/s ≈	<2 ms	4.7
(mandatory for H.323 as common denominator)			
▪ G.728	16 kbit/s	2-10 ms	4.3
▪ G.729A	8 kbit/s	10 ms	4.3
▪ G.723.1	5.3 / 6.3 kbit/s	50-60 ms	3.6 / 4.3

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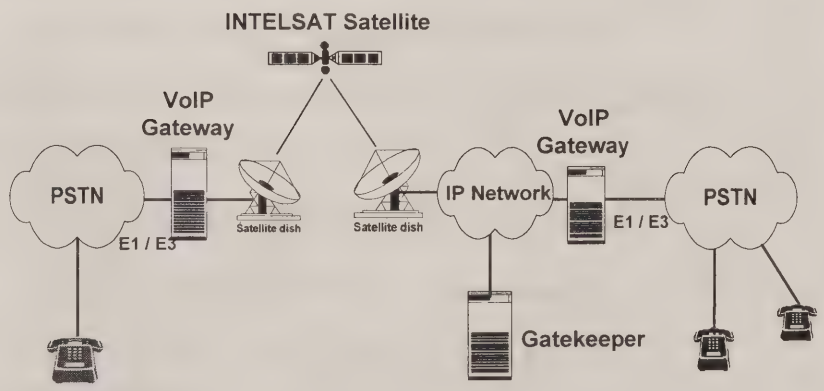
Possible Carrier Configuration



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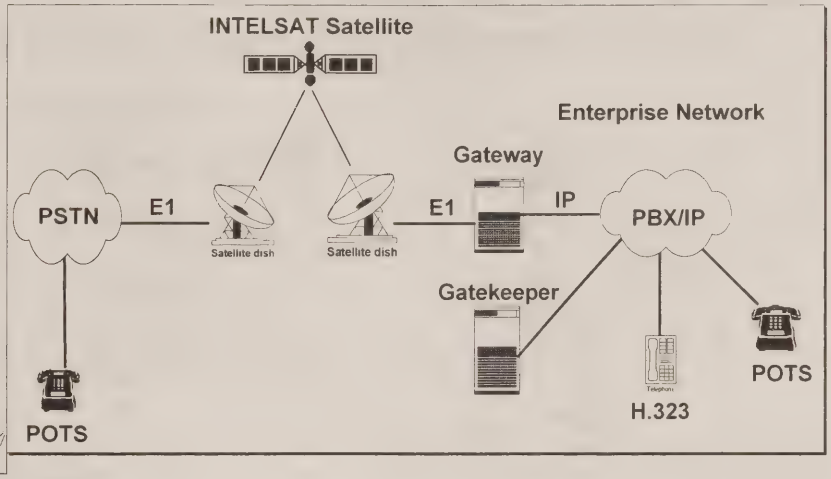
Possible Enterprise Configuration



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Rural Communications: A Good Starting Point for VoIP

- Fast deployment
- Less than perfect voice quality generally acceptable
- Minimum costs and skills to operate and maintain the equipment
- Low primary power requirements
- Suitable for low density traffic
- Less regulatory issues

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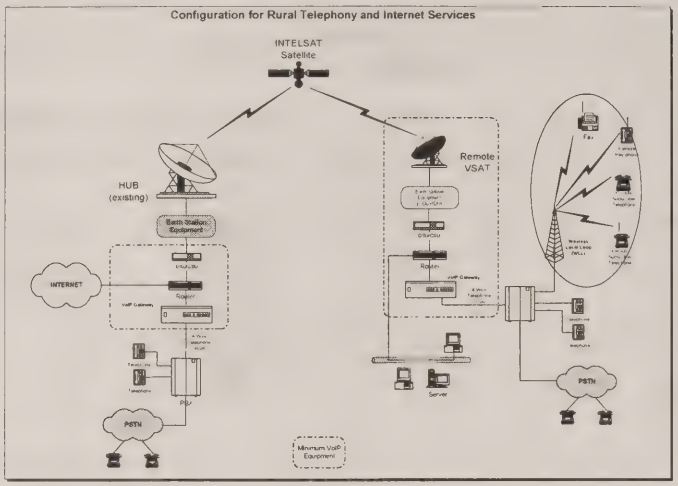
VoIP in Thin Route Telephony / WLL



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VoIP over Satellite

- INTELSAT accepted as a part of ETSI's TIPHON Net
- Benefit
  - Can bypass congested link
  - No jitter / very good BER
  - Rapid deployment
- Issue
  - Delay is not a major issue if echo canceler is installed

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INTELSAT Initiatives Technical Labs

- Characterizing VoIP performance with respect to:
  - Latency and Jitter
  - Frame Losses
  - Codecs
- On going activity

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INTELSAT Initiatives Technical Labs (con't)

- Demonstrations
  - Various INTELSAT sponsored Workshops, Seminars and GTMs
  - ETSI/TIPHON in Philadelphia and Bangkok
- Planned Field Trial
  - Thin route telephony and Internet access in Kenya

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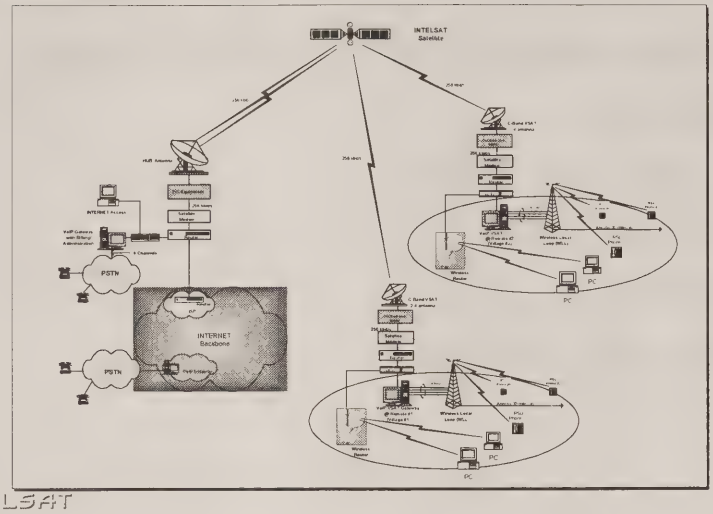
Kenya Field Trial



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Questions?

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THANK YOU

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Broadband VSAT Overview

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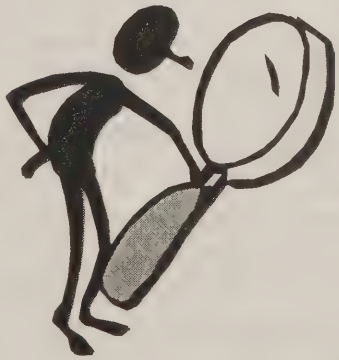
Today We Will Focus On



- Why BVSAT?
- New Trends and Technologies
- Service Concept
- Target Market
- Service Features
- Illustrative Equipment Costs
- Benefits to Customers
- BVSAT Positioning
- Deployment Plan
- BVSAT Process

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Why Broadband VSAT?

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Why is INTELSAT Introducing BVSAT Service?

- New Trends in Business Communications:
  - Increased need to share information resources between geographically separated facilities
  - Communication costs becoming a critical component
  - Increased performance requirements for applications such as real time video traffic.
- Single Solution for Multimedia Requirements:
  - Network convergence of Voice, Data and Video
  - Protocol convergence from multiprotocol to IP.

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Customer Requirements

- Greater flexibility
- Increased reliability
- Lower costs
- Global coverage
- Higher bandwidth

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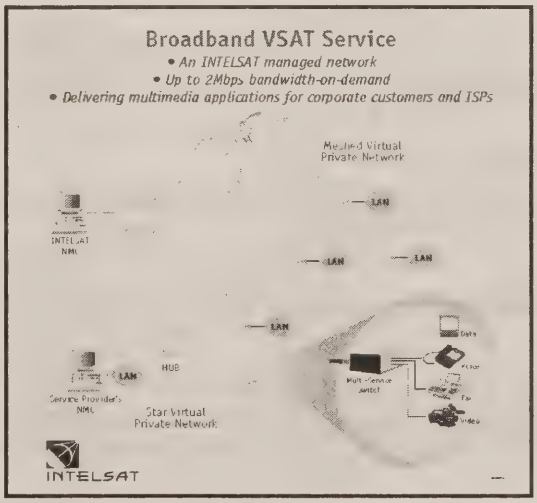
How Can Service Providers Offer These Features?



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BVSAT Overview

- Wholesale, on-demand capacity
- Bursting capabilities
- Seamless support for terrestrial protocols: IP, FR, ATM, ISDN, SS7, ETHERNET
- Pre-negotiated prices for terminal equipment
- Four managed networks with global coverage

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More BVSAT Characteristics

- Typical antennas:
  - C-band (2.4m & 3.7m)
  - Ku-band (1.8m & 2.4m)
- Guaranteed transmission quality:
  - 99.6% Availability at < 10^{-8} BER
- Carrier sizes:
  - Virtual circuits from 64 kbit/s to 2 Mbit/s
- Service categories:
  - Permanent Virtual Circuits (PVC)
  - Switched Virtual Circuits (SVC)

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Broadband VSAT Target Markets

Service Providers serving the Corporate Market

- VPNs
- LAN/WAN Interconnection
- Video-conferencing
- Tele-Medicine
- Tele-Education
- Telephony

Service Providers serving the Internet market

- Thin routes ISP to POP
- ISP Backbone access

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Service Categories

- Permanent Virtual Circuits (PVC):
  - Flat monthly fee
  - Contract duration of 1, 2 and 3 years
  - Three service qualities
  - Service available in July 2000
- Switched Virtual Circuits (SVC):
  - Available on-demand
  - Per minute fee
  - Three service qualities
  - Service available in 2Q 2001

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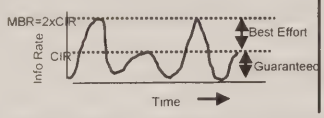
Flexible Service Qualities

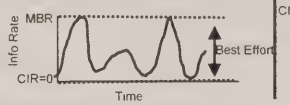
PVC or SVC

CIR>0
with MBR=2xCIR



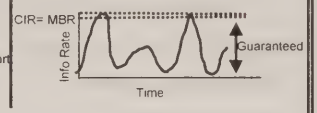
CIR=0

40% cheaper than CIR>0



CIR=CBR=MBR

No bursting capability
15% cheaper than CIR>0



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INTELSAT Network Management

- Operation of the Network Control Center (NCC) and Network Management Center (NMC):
  - 24h control and monitoring of the carriers
  - 24h helpdesk functions
  - Carrier assignment on a dynamic basis
- Booking and Billing Management
- Network and Traffic Design

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Equipment Vendor Terminal & Costs

- COMSAT Lab is equipment manufacturer
- Sole vendor platform: COMSAT Labs Linkway products
- Three models: Linkway IP, Linkway 2000, Linkway 2100
- Typical terminal costs range from $13,000 - $25,000
  - Included: IDU, ODU, HPA, Cables
  - Not included: antenna, typically: $500 - $2000 (Ku-Band)
  - Terminal Price depends on Model, Interface Cards, HPA size

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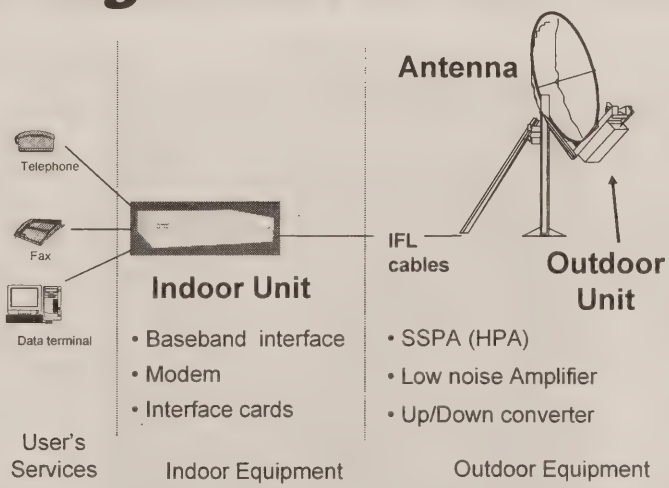
Typical Antenna Configuration



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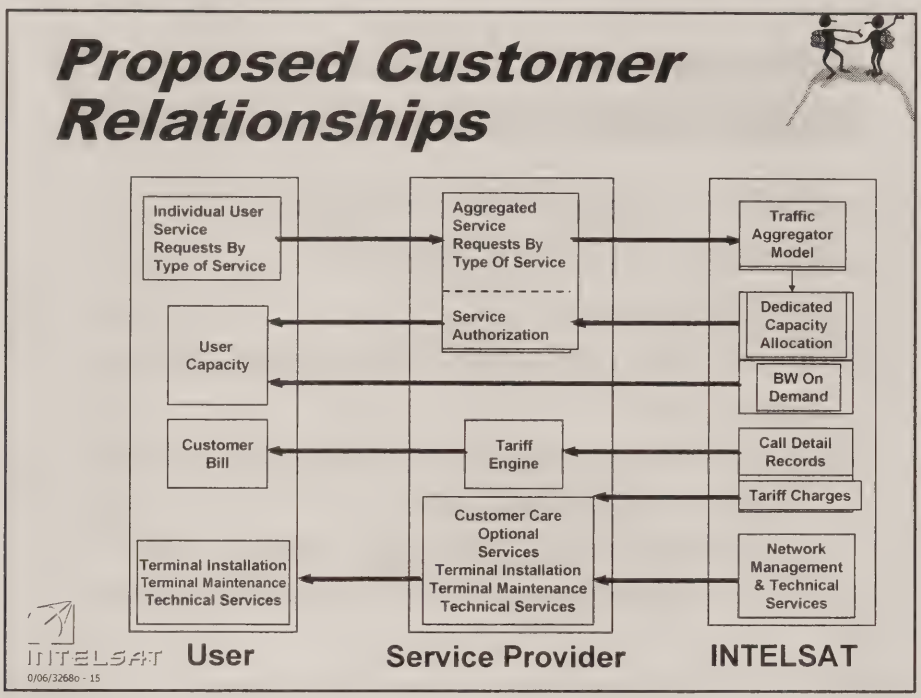
Proposed Customer Relationships
Individual User Service Requests By Type of Service
Aggregated Service Requests By Type Of Service
Traffic Aggregator Model
Service Authorization
Dedicated Capacity Allocation
User Capacity
BW On Demand
Customer Bill
Tariff Engine
Call Detail Records
Tariff Charges
Customer Care Optional Services Terminal Installation Terminal Maintenance Technical Services
Terminal Installation Terminal Maintenance Technical Services
Network Management & Technical Services
INTELSAT
User
Service Provider
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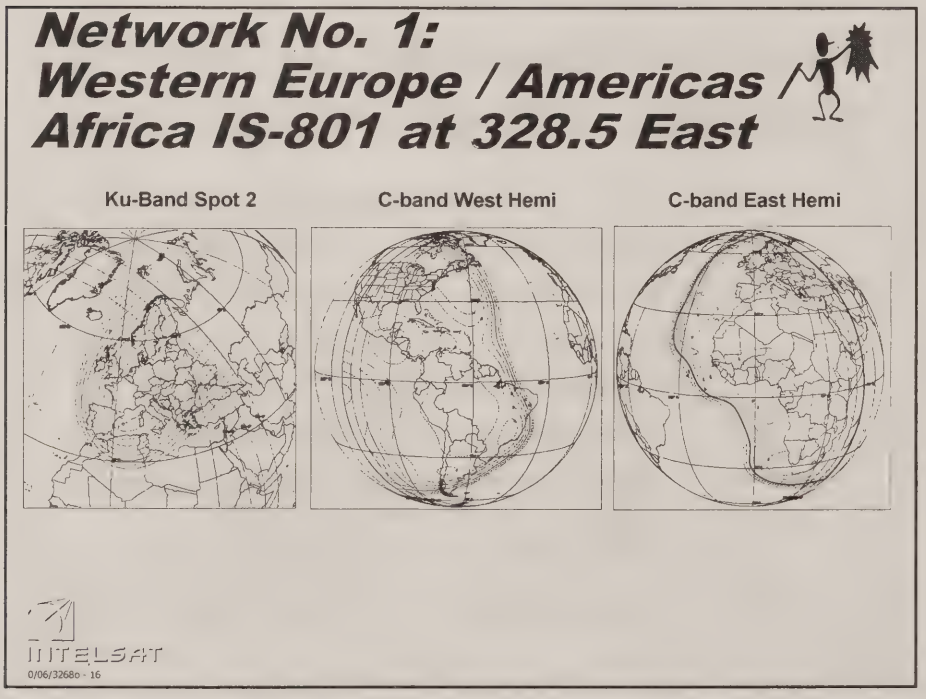
Network No. 1: Western Europe / Americas / Africa IS-801 at 328.5 East
Ku-Band Spot 2
C-band West Hemi
C-band East Hemi
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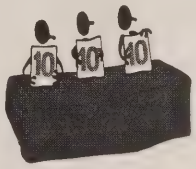
Network No. 1:

- Connectivities Offered:



- WH/WH : C-band Loop back in the Americas
- S2/WH & WH/S2: Ku-band in Europe to/from C-band in the Americas
- S2/S2: Ku-band Loop back in Europe
- EH/S2 & S2/EH: Ku-band in Europe to/from C-band in Africa
- EH/EH: C-Band Loop back in Africa

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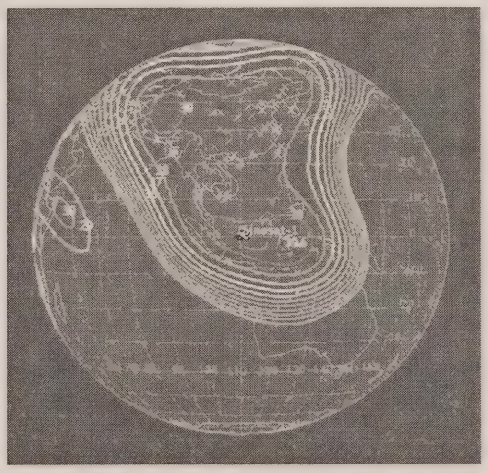
Network No. 2: Pan-Asia APR-2 at 110.5E

C-Band Zone



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Network No. 2:

- Connectivities Offered:
  - Wide Beam/Zone Beam:
  - C-band Loop back in all of Asia

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Network No. 3: Europe to Asia IS-804 at 64 East

Ku-Band Spot 1

C-Band Northeast Zone

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Network No. 3:

- Connectivities Offered:

- NE/S1 & S1/NE: Ku-band in Europe to/from C-band in North East Asia
- NE/NE: C-band Loop back in North East Asia

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Network No. 4: Europe To Middle East IS-902 at 62 East

Ku-Band Spot 1

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Network No. 4:

- Connectivities Offered:

- All Ku-band
- S1/S2 & S2/S1: Europe to/from Middle East
- S1/S1: Loop back in Europe
- S2/S2: Loop back in Middle East

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BVSAT Compared to Other INTELSAT Services

FEATURES	VSAT IBS	DAMA	Leases	BVSAT
Managed Network Service		☆		☆
Guaranteed QoS levels	☆	☆		☆
Bandwidth-on-demand		☆	☆	☆
Usage-based pricing		☆		☆
Broadband data rates	☆		☆	☆
Bursting capability			☆	☆
Dedicated growth capacity		☆		☆
Supports small antennas	☆		☆	☆
Simultaneous multiple transponder operation				☆

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Conclusion

Customer Requirements:	BVSAT Features:
✓ Higher Bandwidth	Virtual circuits up to 2 Mbit/s
	Reserved capacity for expansion
✓ Greater Flexibility	Supports different configurations
✓	Supports multiple terrestrial protocol
✓ Increased Reliability	Guaranteed transmission quality
	INTELSAT managed networks
✓ Reduced Costs	Usage-based tariffs with multiple options
	INTELSAT operated NCC & NMS
	Pre-negotiated terminal prices
	Powerful coverage enables small antenna sizes
✓ Global Coverage	Four managed networks with global coverage

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INTELSAT's Next Generation Broadband Services

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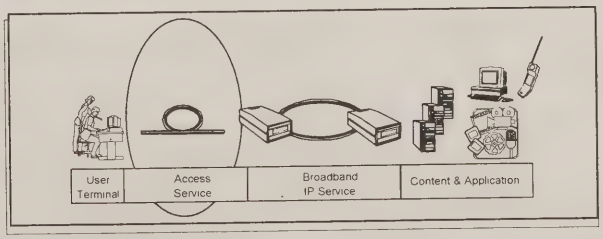
Emerging Broadband Requirements



- Evolution toward shared content and applications with access to IP backbone
- Access services to the backbone remain the bottleneck for end users
- Satellite is an attractive option to provide:
  - Last mile access
  - Secure private network solutions

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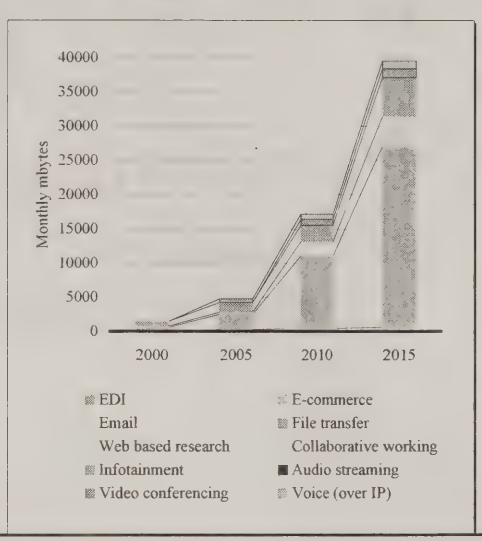
Drivers of Broadband Demand



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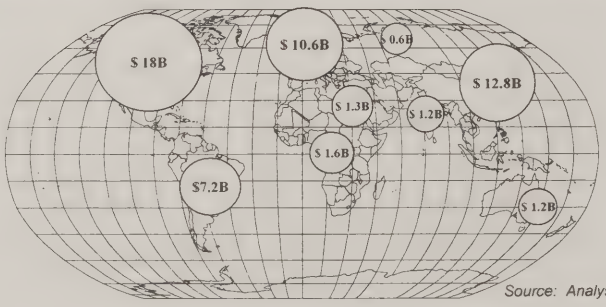
Market Opportunity for Satellite Broadband



Source: Analysys, 1999

- The Opportunity for Broadband Satellite is attractive
  - Growing to US$54.3 billion in 2015
  - Serving Business and Residential Users
  - Asia-Pacific and Oceania as primary market region

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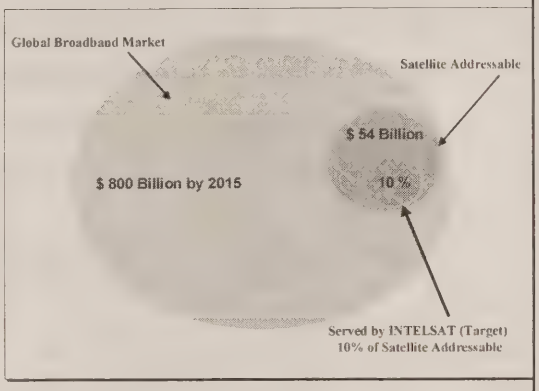
Satellite Completes the Offering for Broadband Services

- Terrestrial technologies overall will predominate, but...
- Terrestrial technologies not cost-effective or available with many areas under-served
  - DSL, Fiber, LMDS, Cable
- Superior coverage and differentiation in performance for satellite at competitive prices
- Expansion of customer base at low incremental cost



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INTELSAT Broadband Service Positioning

- Broadband access service
  - Last mile
  - Private network
- Complement terrestrial offering
- Solutions for business and residential users
  - Large, multi-site corporations
  - Small and medium size enterprises
  - Multi-dwelling units and potentially single-home residential customers
- Wholesaler to Service Providers

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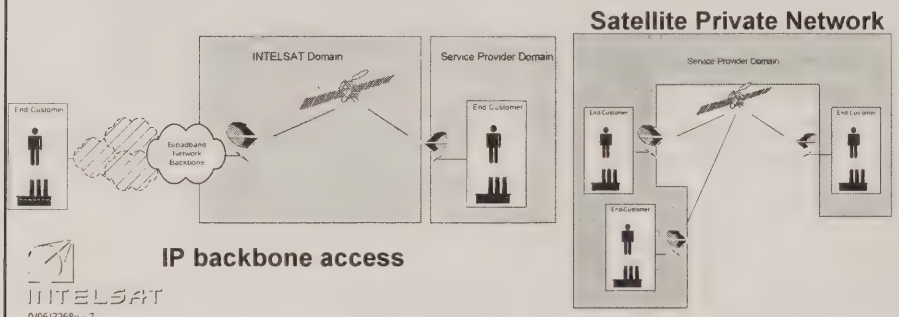
Potential Service Positioning

- **INTELSAT Offers:** managed satellite network infrastructure to service providers to support two-way IP backbone access and potentially private network application to business & residential users



IP backbone access

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INTELSAT Broadband Service Roll-out Plan

- Near term: Use existing in-orbit C & Ku-band capacity
  - VSAT applications, e.g. BVSAT
  - Interactive services, interactive multimedia terminals
  - Data streaming
- Long term (2003): Next Generation Broadband Platform
  - Multi-beam Service
  - Alternatives: On-board Processing Satellites (OBP) or Bent-pipe Satellites
  - Acquisition decision 4Q2000
  - ***Available late 2003***

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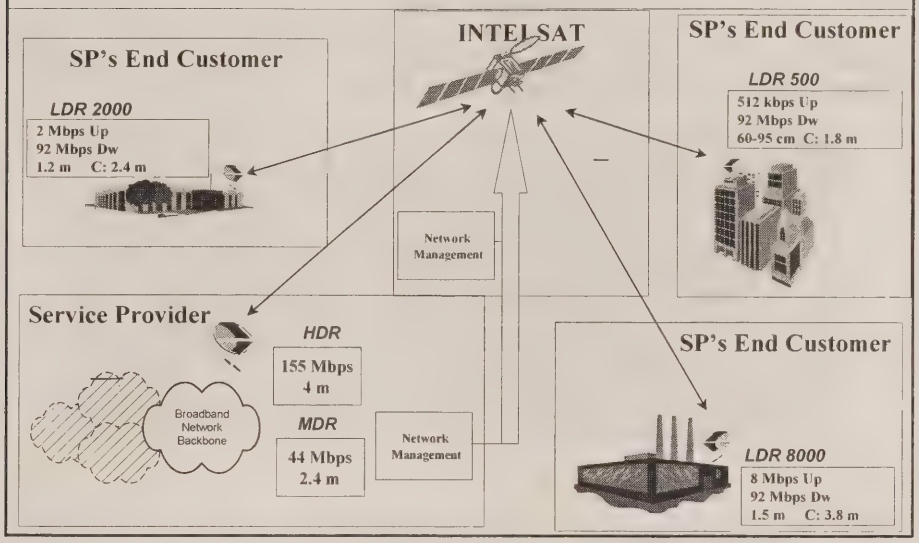
Platform Concept



INTELSAT Broadband Platforms - Features and Benefits

Features	Benefits
High capacity satellite (>8Gbps)	• Ensures sufficient capacity to meet market needs • Lower usage costs
Ka or Ku spot beams: 50 user beams per satellite 10 gateway beams per satellite	• Full landmass coverage • Lower wholesale price • *Smaller terminal at lower cost*
Choice of Network Management	• Revenue optimization • Flexible capacity and network planning • Service bundling capabilities
Quality of Service Guarantees	• Improved access quality for customers

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Potential Orbital Locations (Ka and/or Ku)

229°E 243.1°E 307°E 359°E 33°E 85°E 137.7°E 157°E

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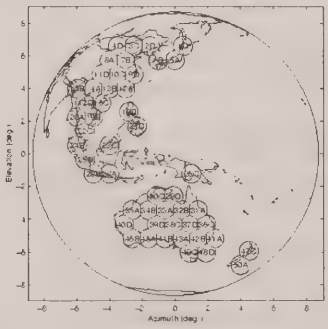
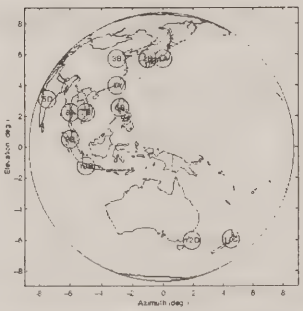
Preliminary Coverage 137.7°E (Ka)

User Beams



Gateway Beams



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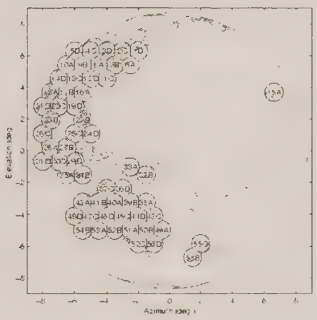
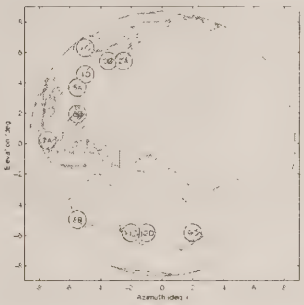
Preliminary Coverage 157°E (Ka in non-tropical/Ku in tropical areas)

User Beams



Gateway Beams



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Wholesale Model With Two Choices of Services

SP Managed Service (Leased Access Service)	INTELSAT Managed Services (Managed Bandwidth Access Service, Full Access Service)
▪ Bulk Capacity Virtual Satellite Network assignment ▪ Bulk Capacity billing ▪ SP managed VSN - on-demand capacity assignment - usage based billing - SP managed QoS ▪ Regional Connectivity ▪ Standard terminals available from vendors	▪ On-Demand capacity assignment ▪ Usage based billing ▪ Network Management ▪ Traffic management and planning ▪ INTELSAT guaranteed QoS ▪ Regional Connectivity ▪ Standard terminals available from vendors

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Summary of Platform Concepts

	Multi-service platform	Last-Mile Access Platform
In-Service Date	2003	2003
Satellite Platform	On-board Processing	Bent-Pipe
Supported Protocols	Multiple Interfaces for voice, video and data • IP • PSTN, VoIP • ATM	IP-based
Connectivity	User-to-User (mesh) User to any Gateway	User-to-Gateway (fixed) User-to-User through terrestrial IP backbone
Services	• IMS (shared VSN) • SPMS (VSN)	• Leased Access • Managed Bandwidth Access • Full Access
Gateway Ownership & Operation	Service Providers	Service Providers or INTELSAT
Non-Exclusivity	Yes	Yes, if INTELSAT responsible for gateway
Terminals	Proprietary and off-the-shelf components	Enhanced off-the-shelf

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Wholesale Pricing Structure

- *Final wholesale rates will depend on QoS, connectivity, terminal type, time and duration of commitment*

Multi-Service Platform (OBP)		Last-Mile Access (bent-pipe)	
Service	Pricing Structure	Service	Pricing Structure
SP Managed Service	Bulk Pricing	Leased Access Service	Flat Monthly Fee for Guaranteed BW, power and connectivity in MHz
INTELSAT Managed Service	Monthly flat rate per site for minimum guaranteed rate + Usage-Based Charge for On-Demand Volume	Managed Bandwidth Access	Flat Monthly Fee for Guaranteed Data Rate *aggregated by SP* + Usage-Based Charge for On-Demand Volume
		Full Access Service	Flat Monthly Fee for Guaranteed Data Rate *on terminal basis* + Usage-Based Charge for On-Demand Volume

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Illustrative End Customer Offering

End Customer	Consumer	SOHO	Small / Medium Businesses	Multiple Site Businesses
Application	Infotainment E-Commerce EDI	E-Business File Transfer Voice-IP	Shared Applications	
Service	Internet Access	Internet Access	Secured VPN	
Product	< 512 kbps access best effort	16kbps to 8 Mbps minimum guaranteed rate with QoS		
Retail Price*	$ 40 - 50 to $ 100	to $200 and ...	up ...	
CPE cost	LDR < 500 $ 1000	LDR500 $ 1000 - 2000	LDR2000 $ 3000	LDR8000 $4000

* Monthly charge excluding any service activation / CPE charge

User terminal costs are indicative

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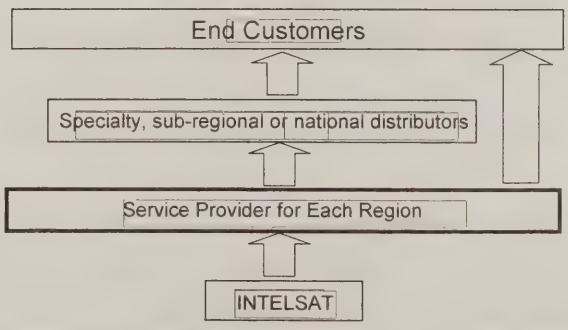
Service Distribution



- All current & future INTELSAT Service Providers are potential candidates
- Telecommunications Operators, Internet Service Providers, Corporate Network Providers, System Integrators, etc.
- Service Providers can operate in multiple regions

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In Summary, INTELSAT will provide...

- Broadband access services
  - To connect end customers to the broadband backbone network
  - To extend and complement the Service Provider's future broadband capabilities regionally and globally
  - To enable a wide range of end-user applications
- Integrated product line including a multi-service platform with full landmass coverage and connectivity

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...and INTELSAT Offers Key Advantages

- Flexible solution with open specification interfaces and price flexibility
- Leading position in the provision of satellite services worldwide
- Strong relationships with leading telecom service providers
- Serving both the developed and developing countries
- Full landmass coverage and connectivity
- High quality technical support
- Enhanced role for the Service Provider as we develop broadband marketing strategy

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Internet @INTELSAT

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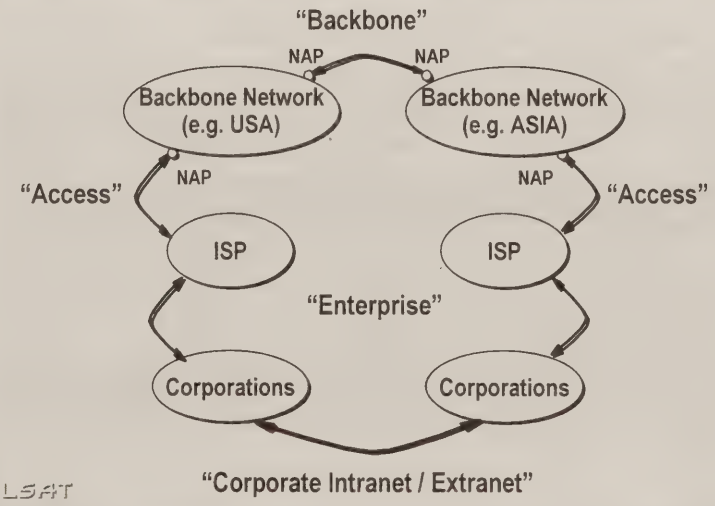
The Internet @intelsat



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Messages

- Internet works over satellite
  - Delay and throughput are non-issues
  - INTELSAT has proof!
- Internet works well over GEO satellites
  - Rapid implementation (case studies)
  - High bandwidth applications (users today)
- Internet works best over INTELSAT satellites
  - Global connectivity and available capacity
  - Technical expertise and system reliability

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Internet Implementation

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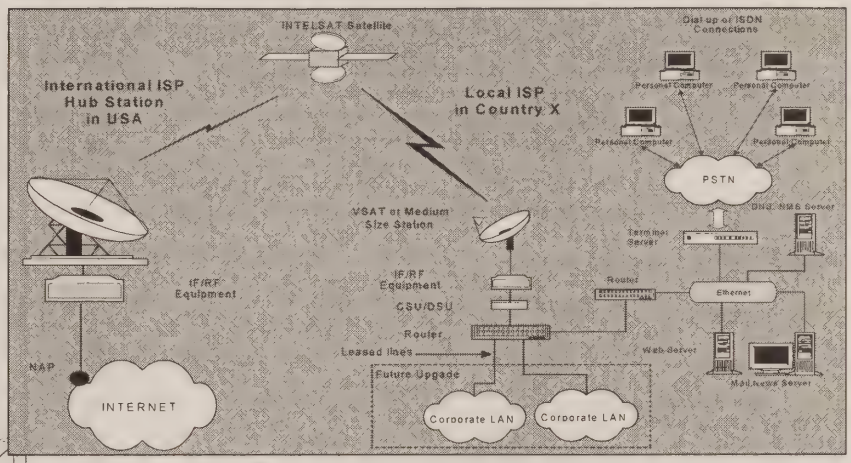
Satellite – Based ISP Implementation Setup



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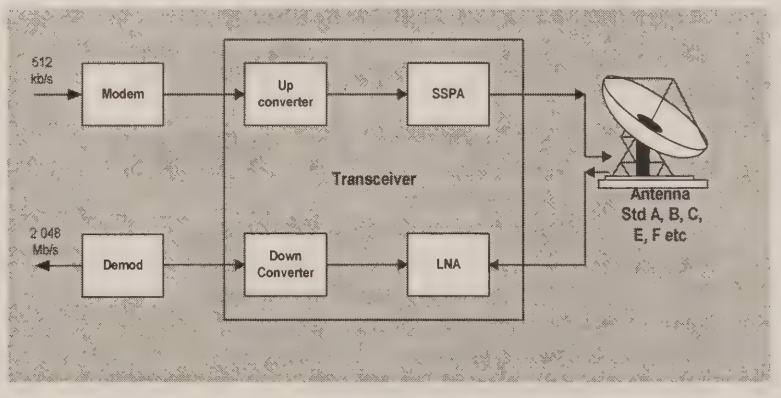
ISP Set-up – Satellite Earth Station Requirements

Earth Station Gateway with associated IF and RF equipment



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Antenna Sizes, Capabilities & Costs

Frequency Band	Earth Station Standard	Typical Antenna Diameter (meters)	G/T (dB/K)	Typical Cost USD ($1,000)
C-Band (6/4 GHz)	A	15.0 - 18.0	35.0	550
	B	9.0 - 11.0	31.7	218
	F-3	7.0 - 9.0	29.0	200
	F-2	5.5 - 7.0	27.0	120
	F-1	3.7 - 4.5	22.7	90
VSATs	H-4	3.7	22.1	20.3
	H-3	2.4	18.3	4.8
	H-2	1.8	15.1	2.7
Ku-Band (14/12/11 GHz)	C	11.0 - 13.0	37.0	180
	E-3	6.0 - 9.0	34.0	160
	E-2	4.0 - 6.0	29.0	120
	E-1	2.4 - 4.0	25.0	90
VSATs	K-3	1.8	23.3	
	K-2	1.2	19.8	

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ISP Set-up: Internet Equipment Requirements

- Routers:
  - One or two routers interconnected by an Ethernet LAN
- A fast Ethernet switch
- Servers:
  - A Fire-Wall server for security
  - Terminal Server with modem banks
    - Allows dial-up users to access the internet
  - Proxy Server: data caching, bandwidth optimization
  - Webserver: Dedicated or shared servers for services to be provided by the ISP: web, mail, FTP, news, etc.
  - Domain Name Server (DNS): Convert valid domain name to IP address equivalents
  - Local Management and Security System:
    - Administration station, security, database, billing etc

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Typical ISP Business Case

INTERNET COMPONENT			
Routers	2	8,000-10,000	16,000-20,000
Ethernet Switch (10/100, 2-3 ports)	1	800-1,500	800-1,500
CSU/DSU (2-8 Mbit/s)	2	1,000-10,000	2,000-20,000
Servers	3	5,000-10,000	15,000-30,000
Cabling	1 Set	5,000	5,000
Installation (15% equipment cost)	1	0	0
Total Cost Internet Component:			**43,800-59,900**

EARTH STATION COMPONENT			
Antenna (Standard F2) with tracking	1	120,000	120,000
Modem	1 + 1	15,000	30,000
Transceiver (20W SSPA, LNA, UC, DC)	1 + 1	20,000	40,000
Cabling & connectors.	1 Set	5,000	5,000
Installation (15% equipment cost)	1	29,000	29,000
Total Cost Gateway Component:			**224,000**
Grand Total:			**267,800-283,900**

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Internet Performance over Satellite Link

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Internet Delivery by Satellite: Technical Issues

- Errors
  - Errors in satellite links tend to be bursty
  - Fewer packets affected
- Latency
  - Geosynchronous satellites introduce one-way constant delay on the order of 260 msec
- Dealing with Congestion

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Internet Delivery by Satellite (with Default Parameters)

- No meaningful difference for access at subscriber bit-rates (dial-up modem, ISDN, frame relay up to 128 kbit/s, LAN)
- Non-satellite factors that have impact on performance
  - Terrestrial lines - Last mile - Backbone congestion
  - Routing delays - Server congestion

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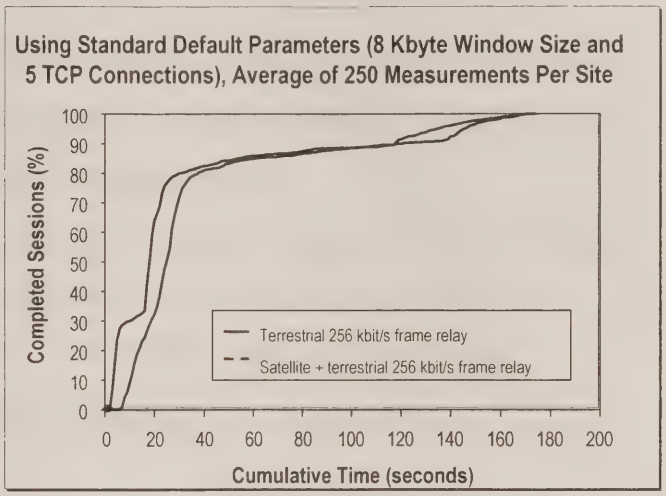
Current TCP Performance – HTTP Satellite based Frame Relay Using 256 kbit/s



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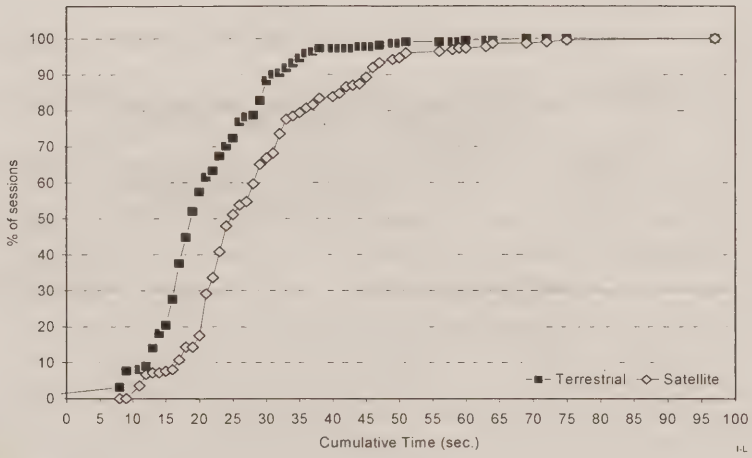
Current TCP Performance – HTTP Accessing Internet Using ISDN 56 kbit/s Over Satellite Link



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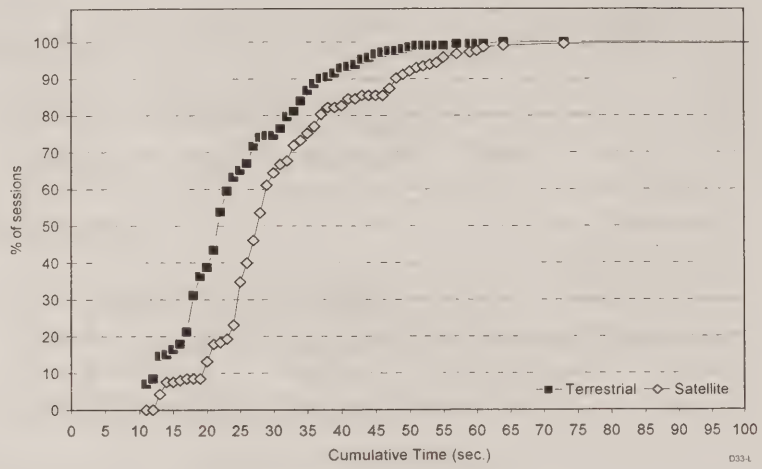
Current TCP Performance Accessing Internet using Dialup Modem 33.6 kbit/s over Satellite Link



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Enhanced TCP/IP

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What Is TCP?

- TCP is an end to end protocol at layer four
- TCP is an acknowledgment based protocol
- Window mechanism
- Slow start (network congestion control)
  - Window size increases as correct ACK comes back
- Error Correction (GO-BACK-TO-N SCHEME)
- But TCP is DELAY SENSITIVE

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What Was Decided

- Implement three RFC's, which are beneficial to large delay environment
- Must be commercial software with existing customer base
- FTP Software, Inc. was selected

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RFC 1323

- Provides large window size
- Window size limitation of 64 kbytes is eliminated

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RFC 2001

- Fast Restart
  - When error is detected, old TCP reduces window size to one. Enhanced TCP uses 50 percent of current window size
- Fast Recovery
  - If same ACK is received three times, enhanced TCP takes it as an indication of error and starts retransmission of the packet before retransmission timer expiration

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RFC 2018

- Selective Acknowledgment
  - If loss of a packet is detected, a sender only sends the lost packet
  - Then continues to send other packet

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Test Criteria

- Better than 70 percent of theoretical throughput at 2 Mbit/s link with 600 ms RTT
- Backward compatibility with existing TCP/IP suites
- Compatibility with Sun Solaris
- Compatibility with Windows 95 and 98

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Test Results

- Ninety-eight percent of theoretical value as throughput
- All other tests were successfully completed

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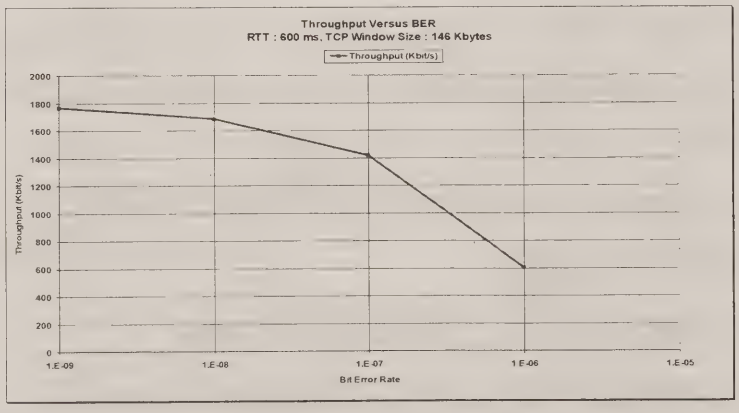
Enhanced TCP at 2 Mbit/s



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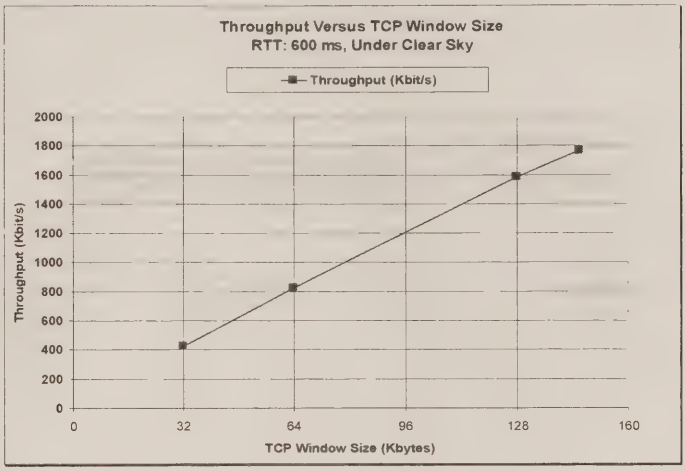
Enhanced TCP at 2 Mbit/s



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HTTP with Enhanced TCP

- Better performance than non-enhanced TCP
  - Five to 20 percent reduction of web page access time
  - Depend on size and number of objects
  - More rigorous testing will be done in the labs
- Other possibilities
  - UDP based browser, UDP based FTP
  - TCP spoofing

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TCP Spoofing

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TCP Spoofing

- TCP Spoofing means...
  - Striping off TCP overhead from the data packet at the gateway,and send the original raw data with a different reliable transport protocol
- Technical Labs tested SkyX by Mentat
- Internet protocol booster
  - Spoofing of TCP acknowledgment
  - DNS caching, including interception and redirection of DNS lookups
  - TCP header compression

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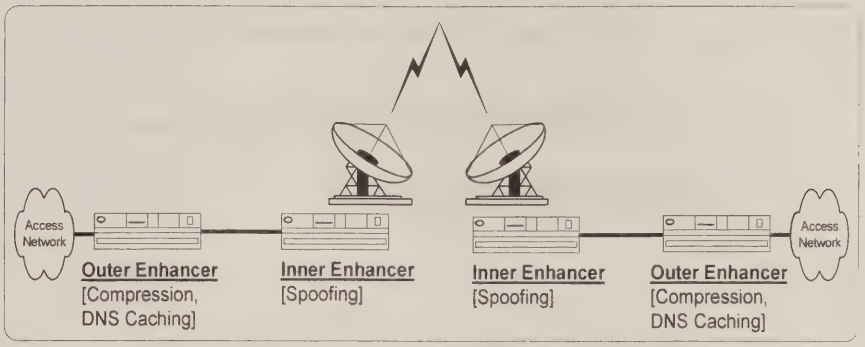
TCP Spoofing Testbed



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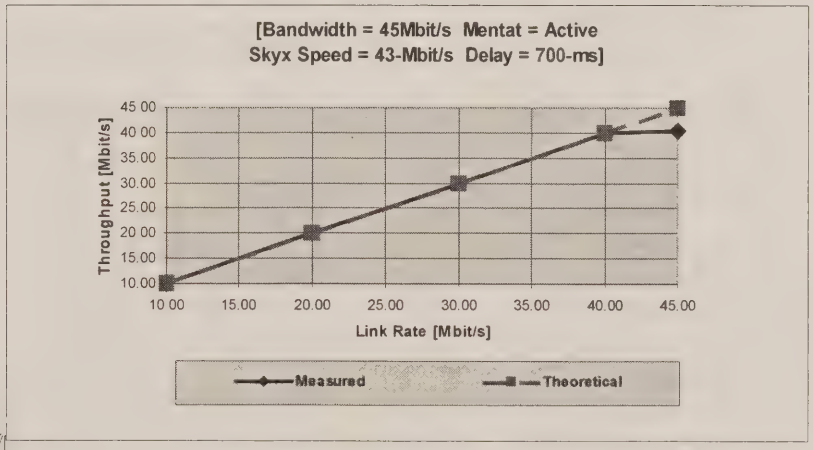
TCP Spoofing - SkyX Single TCP Result



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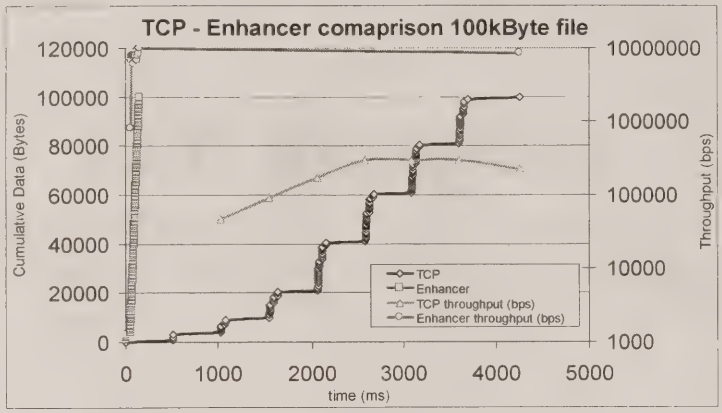
TCP and Protocol Booster Performance Results



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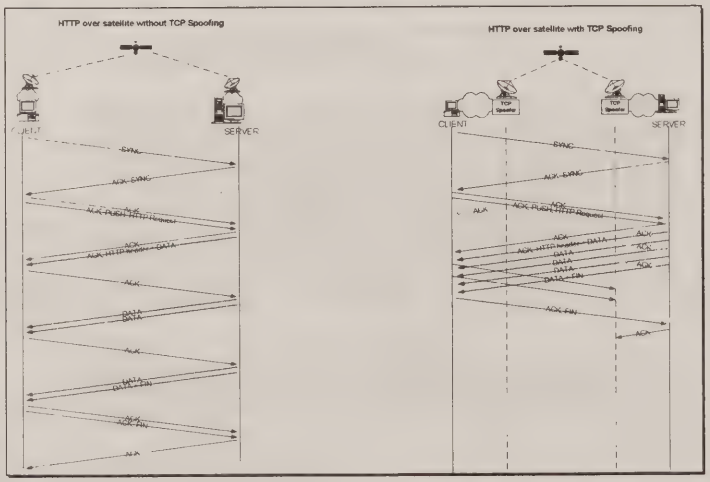
Browsing with TCP Spoofing



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Asymmetric Internet

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Why Consider Asymmetric Service?

- Conserve Resources
- Reduce Costs

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Traditional Telephony Service

- Switched Circuit Technology
- Dedicated Physical Medium
- Average bandwidth is about the same in both directions

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Packet Data Service

- Routed Packet Technology
- Shared Physical Medium
- Average bandwidth may be much greater in one direction than the other

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Bandwidth for Internet Services

- Bandwidth from Client to Server is relatively small
  - Requests
  - Acknowledgments

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Bandwidth for Internet Services

- Bandwidth from Server to Client is much greater
  - Images... World Wide Web
  - Data Files
  - Streaming Audio / Video

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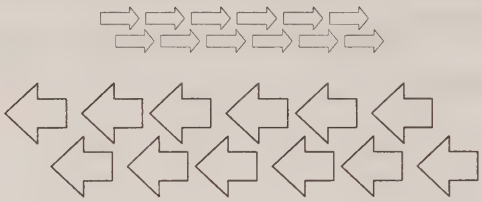
Internet Backbone Connection

- Links that mainly connect clients to the Internet backbone will have asymmetrical traffic.



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Configuration Issues for Asymmetric Service

- Clocking
- Interfaces
- Terrestrial Transport

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Configuration Issues for Asymmetric Service

- Clocking
- Interfaces
- Terrestrial Transport

- Must provide asymmetric clocks to modems and routers
- Modem must support different clock in each direction

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Configuration Issues for Asymmetric Service

- Clocking
- Interfaces
- Terrestrial Transport

- Must integrate various types of interfaces to carry the traffic

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Configuration Issues for Asymmetric Service

- Clocking
- **Interfaces**
- Terrestrial Transport

Up to 2 Mbit/s

- **V.35, RS-449, G.703, HSSI / ECL**

Above 2 Mbit/s

- **HSSI/ECL, G.703 only**

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Configuration Issues for Asymmetric Service

- Clocking
- **Interfaces**
- Terrestrial Transport

Special Equipment

- **DSU/CSU's**
- **Transmit / Receive Splitters**
- **Adapters to provide hardware handshaking signals**
- **Interface Converters**

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Configuration Issues for Asymmetric Service

- Clocking
- Interfaces
- Terrestrial Transport
- Must interface with terrestrial links which are more limited in rates, and are symmetric by design

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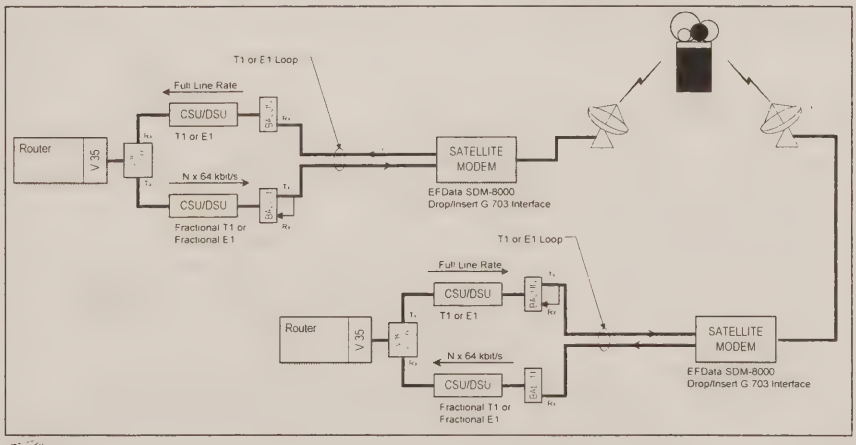
Low Rate Service (E1 or Less)



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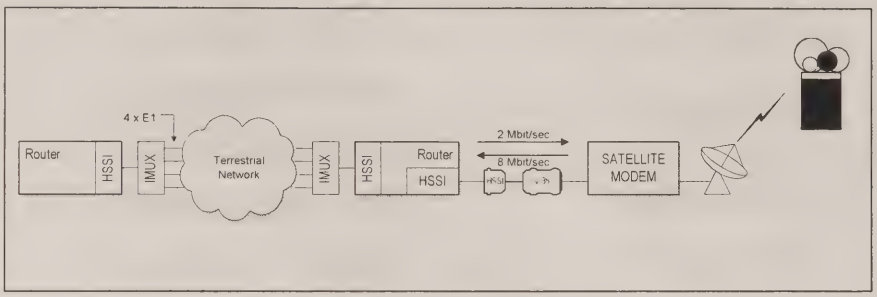
8/2 Mbit/s Using Inverse MUX



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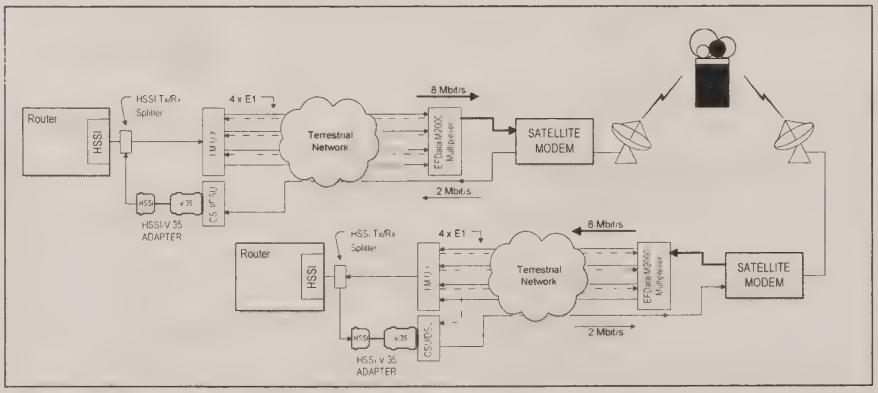
8/2 Mbit/s Using Inverse and PDH Muxes (No Router at Earth Station)



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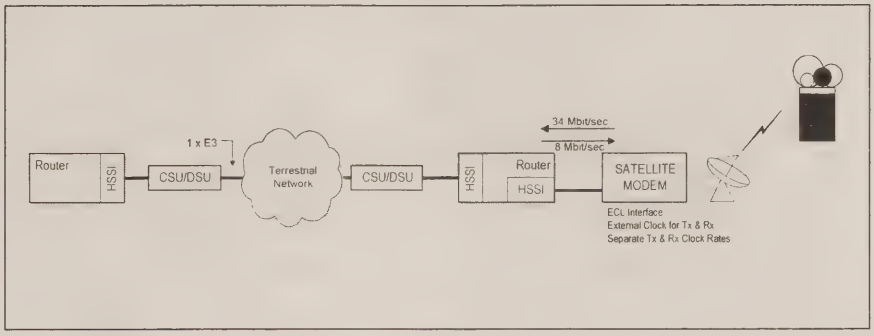
34/8 Mbit/s



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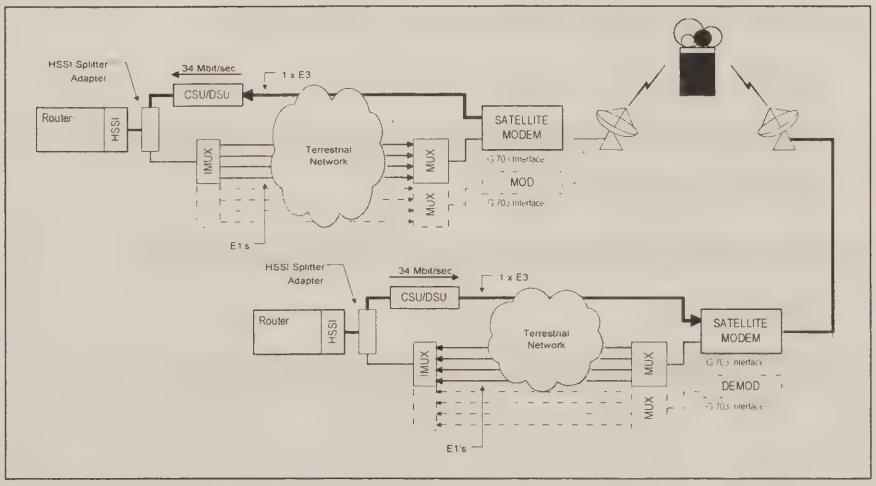
34/8 Mbit/s, E3/E1 Terrestrial



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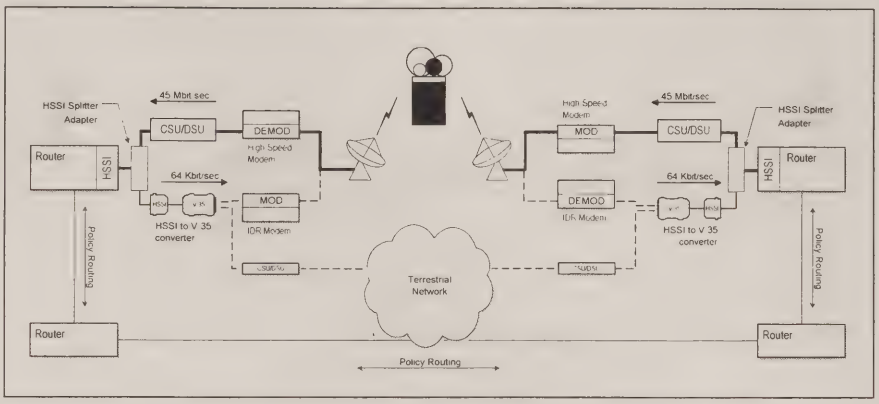
High Rate Unidirectional Service



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CONCLUSION

- Satellite can deliver in excess of subscriber access speed
- INTELSAT technical platforms ensure performance
- Studies prove latency transparent to end user
- INTERNET works well over satellite

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Questions?

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DVB-IP

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Presentation Outline

- DVB
  - DVB TECHNOLOGY
  - DVB-IP TECHNOLOGY
  - EXAMPLE OF SERVICES
- Ku Band INTERACTIVE MULTIMEDIA TERMINAL
  - General System Outline
  - Technical Feasibility
- Example of Service Implementation

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What is the DVB Project?

- A market-led initiative to standardize digital broadcasting worldwide
- DVB was formed in September 1993
- DVB now has more than 220 members from more than 30 countries:
  - Broadcasters
  - Manufacturers
  - Network operators
  - Regulatory bodies

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DVB Technology

- Provides a complete solution for DTV and data broadcasting across a wide range of delivery media
- Uses MPEG audio standard for sound-coding system
- Uses open and inter-operable standards
  - DVB-S for satellite digital multi-program
  - DVS-C for digital multi-program by cable
  - DVB-T for terrestrial
  - DVB-SI for Service Information in DVB systems
  - ...

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DVB-IP Satellite Technology

- Cell-based transmission technology
  - IP encapsulation into 188-byte packets
  - Single carrier with multiplexed virtual channels
- DVB-based simplex IP service
- Uses IP/transmission broadcast multiplex system
  - Burstable IP access service
  - Broadcast-enabled services like caching, news-feeds and streaming
- Improves transponder capacity and lowers transmission cost
  - Saturated transponder, where possible
  - Dynamic bandwidth management
  - Multicasting/caching and broadcasting

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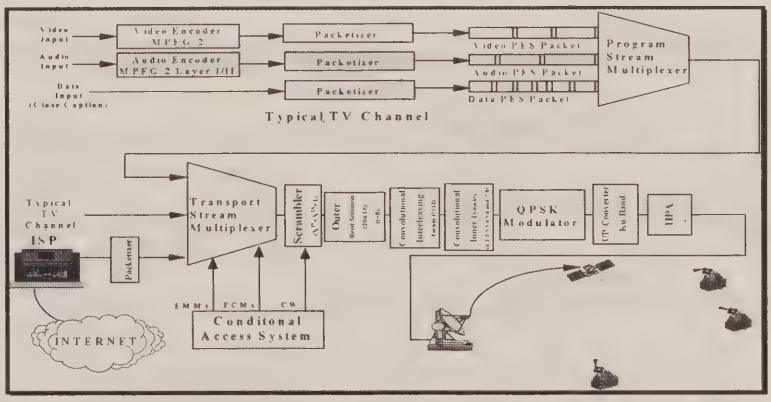
DVB-S Transmission System



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DVB-IP Satellite Service

- DVB-IP consists of virtual channels called PIDs (Packet Identifiers)
- PIDs can be configured for
  - One per receiver terminal
  - Multicast/Broadcast channel
- Each remote receive terminal can receive one or multiple PIDs
- PID bandwidth limits (Burstable Bit Rare and Constant Bit Rate) are implemented through Traffic Shaper

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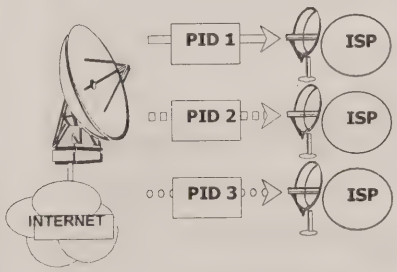
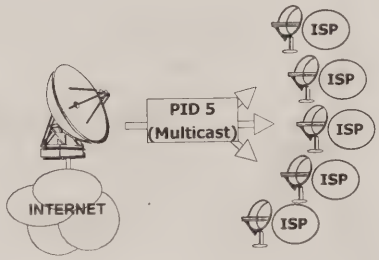
DVB-IP Service Examples

ONE PID PER ISP



ONE PID For Multicast/Broadcast



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Last Mile Distribution Using MPEG/DVB

- Services can be distributed directly to users using the MPEG2/DVB technology widely used in DTH video services today.
  - MPEG permits the combining of any type of digital information, e.g. video, audio or Internet, into a single data stream.
  - Low-cost ground receiver equipment (i.e. set-top boxes) due to the large mass market for DTH equipment.
- Ground terminals and hub equipment needed for the service are commercially available already from several manufacturers.

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DVB/IP Benefits to Customer

- Costs
  - Lower cost than terrestrial alternative for broad(er) band services
  - Reduce/eliminate local license fees with receive-only
  - Rapid implementation
  - Small capital investment - Low cost receive-only VSATs
- Performance
  - Bypasses terrestrial backbone congestion with direct connection
  - Relieves international link by feeding real-time traffic (rich streaming media, data broadcasting and cache-updates) via DVB/IP link

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DVB/IP Benefits to Customer

- Value-added Services
  - Service to multiple locations
  - On-demand bandwidth management to multiple services
  - Rich media streaming Multicasting & caching

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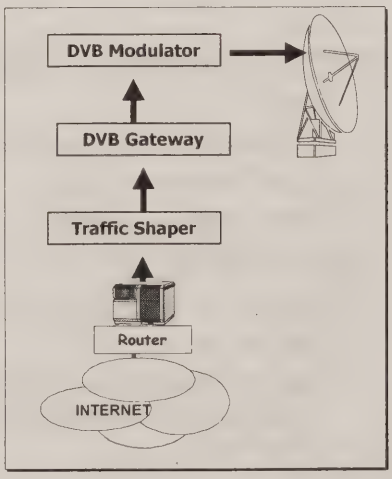
DVB-IP Up-link Equipment

- Traffic shaper
  - Performs QoS functions on customer's IP traffic
- DVB Gateway
  - Encapsulates IP packets into 188 MPEG2 datagramme
- DVB Modulator
  - Multiplexes customer's IP traffic into PIDs by checking the destination IP address



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DVB-IP Remote Equipment

- Outdoor Unit
  - Satellite TVRO dish (2.4 - 4.9m) with LNB
- DVB-IP Indoor Unit
  - PC and DVB-IP PCI card
  - TV set
  - IP Telephone Hand set
  - Functions
    - demodulation
    - demultiplexing
    - LAN Gateway
    - MAC addressing

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DVB Compliant Equipment and Services

- Some compliant equipment
  - Broadcast Technology Ltd
  - Toshiba Corporation
  - Teracom
  - Compaq
  - Tektronix
  - Sony
  - Cisco
  - Skystream
  - Xcom
  - Philips
- Some compliant services
  - Canal plus
  - Alcatel
  - Orbicom
  - Scientific Atlanta
  - Sagem
  - Sony Manafacturing

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Ku-band Interactive Multimedia Services

- Value-added services leveraged on the existing Direct-to-Home video broadcasting infrastructure and low-cost set-top boxes
- Services targeted:
  - DTH video, Interactive DTH video (e.g. Per-Per-View or Near-Video-on-Demand)
  - Internet services (WWW, email and etc.)
- Services provided via 2-way Ku-band satellite links
- Low-cost user terminals

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INTELSAT Activities in Ku-band Interactive Multimedia Services Development

- Has developed with Media4, Inc. (based in Atlanta, Georgia, USA) an engineering model to prove the concept
- Objectives of the system development effort:
  - Determine technical feasibility (e.g. low-cost user terminals, access scheme and etc).
  - Determine system capacity requirements and size of users / subscribers
  - Perform business case analysis
- Equipment available from several manufacturers
  - Alcatel
  - Gilat

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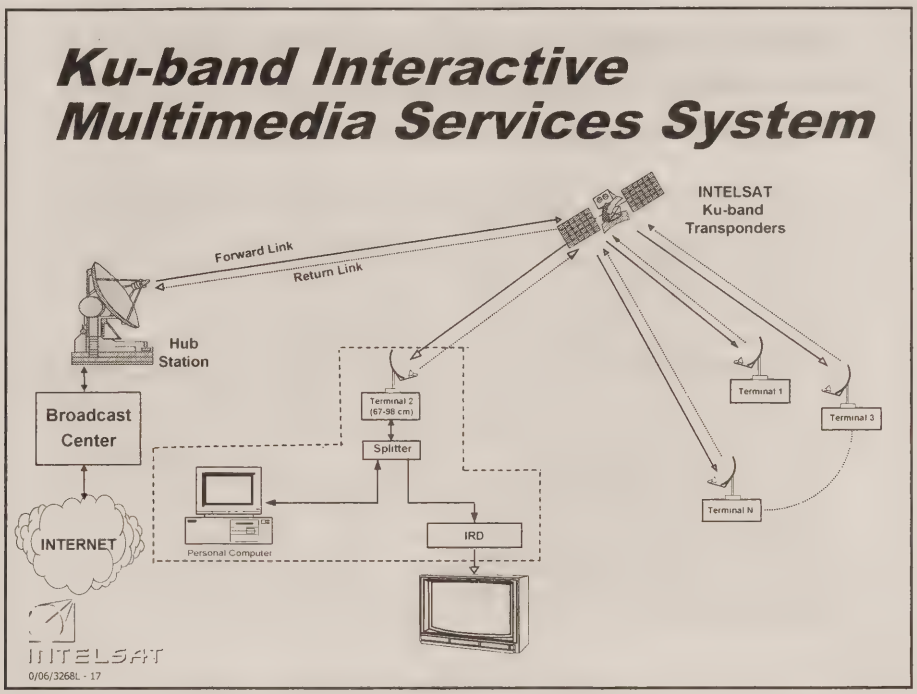
Ku-band Interactive Multimedia Services System
INTELSAT Ku-band Transponders
Forward Link
Return Link
Hub Station
Broadcast Center
INTERNET
Terminal 2 (67-98 cm)
Splitter
Personal Computer
IRD
Terminal 1
Terminal 3
Terminal N
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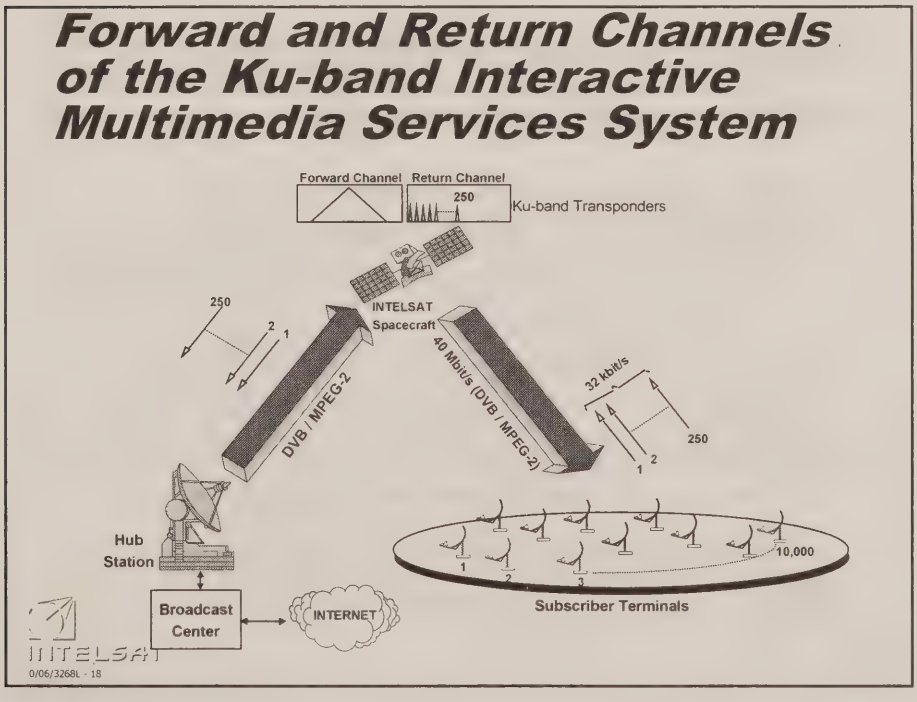
Forward and Return Channels of the Ku-band Interactive Multimedia Services System
Forward Channel
Return Channel
250
Ku-band Transponders
INTELSAT Spacecraft
250
2
1
DVB / MPEG-2
40 Mbit/s (DVB / MPEG-2)
32 kbit/s
250
2
1
Hub Station
Broadcast Center
INTERNET
1
2
3
10,000
Subscriber Terminals
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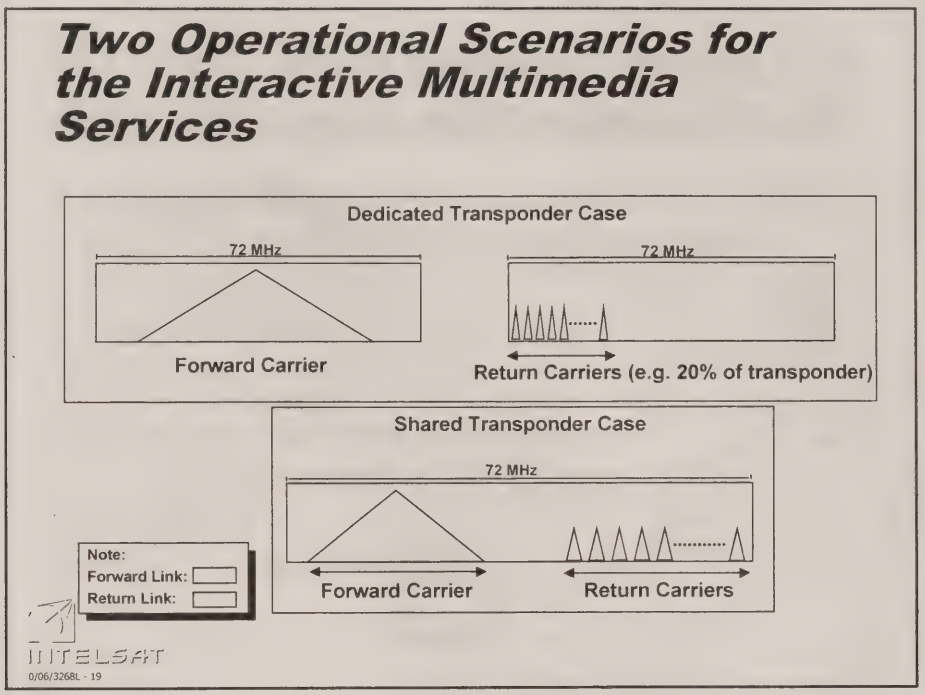
Two Operational Scenarios for the Interactive Multimedia Services
Dedicated Transponder Case
72 MHz
Forward Carrier
72 MHz
Return Carriers (e.g. 20% of transponder)
Shared Transponder Case
72 MHz
Forward Carrier
Return Carriers
Note:
Forward Link:
Return Link:
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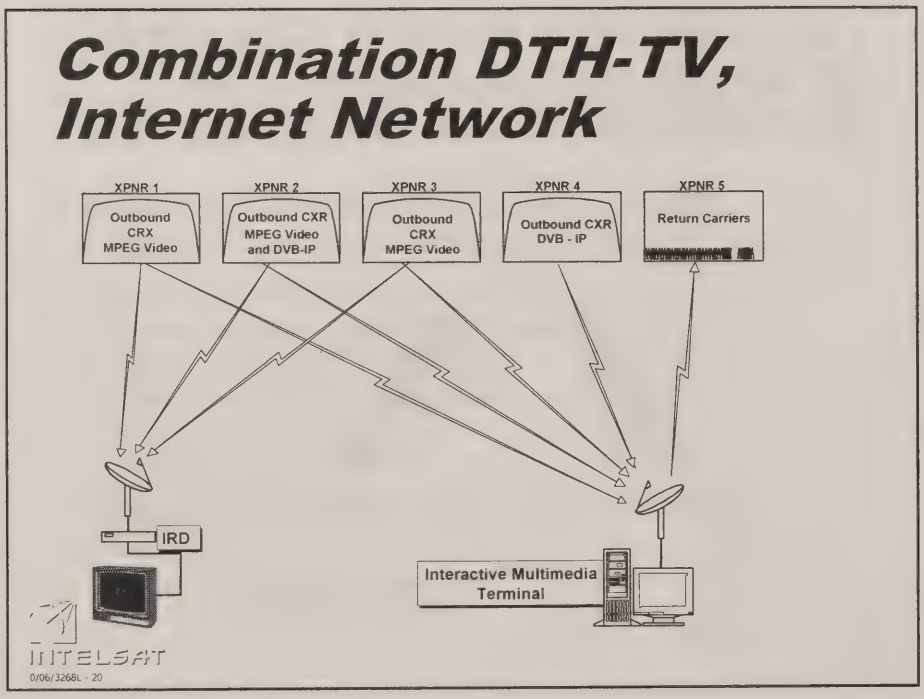
Combination DTH-TV, Internet Network
XPNR 1
Outbound CRX MPEG Video
XPNR 2
Outbound CXR MPEG Video and DVB-IP
XPNR 3
Outbound CRX MPEG Video
XPNR 4
Outbound CXR DVB - IP
XPNR 5
Return Carriers
IRD
Interactive Multimedia Terminal
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Key Characteristics of Space and Ground Segments used in the Transmission Feasibility Analysis

Space Segment

	IS-6	IS-7	IS-8
EIRP [1] (dBW)	44.7	44.5	47.0
G/T [1] (dB/K)	1.0	4.5	5.0
Saturation Flux Density (dBW/m^2)	-84.0	-84.0	-84.0

[1] Inner beam edge coverage

Ground Terminals

	Antenna Type	Antenna Diameter	Min. Receive G/T
Remote Terminal	Sub-meter	0.98 m	19.8 dB/K
Hub Station	E2	4.60 m	29.0 dB/K
	E3	5.60 m	34.0 dB/K

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Key Capacity and Transmission Analysis Results for the Forward Link (IS-VII)

	Dedicated XP Case	Shared XP Case
Maximum Bit Rate (Mbit/s)	40.4 [1]	22.0 [1]
Maximum # of Simultaneous On-line Users	10,100 [1]	5,475 [1]
Up-link Margin (dB)	8.4	4.0
Down-link Margin (dB)	5.0	4.8
Hub HPA size (E2)	690 Watts	290 Watts
Hub HPA size (E3)	466 Watts	200 Watts

[1] Numbers based on a E3 hub. Capacity for E2 hub case is slightly (1~2%) lower than that of E3 case.

[2] A 40 Mb/s forward link carrier can support approximately 10,000 simultaneous on-line users. Whereas for each 32 Kb/s return carrier, it can support approximately 40 simultaneous on-line users.

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Key Capacity and Transmission Analysis Results for the Return Link (IS-VII)

	Dedicated XP Case	Shared XP Case
Up-link Margin (dB)	4.0	4.0
Down-link Margin (dB)	8.2 (E3) and 6.8 (E2)	8.0 (E3) and 6.0 (E2)
Remote SSPA size (with E2 Hub)	0.62 Watts	0.9 Watts
Remote SSPA size (with E3 Hub)	0.24 Watts	0.5 Watts

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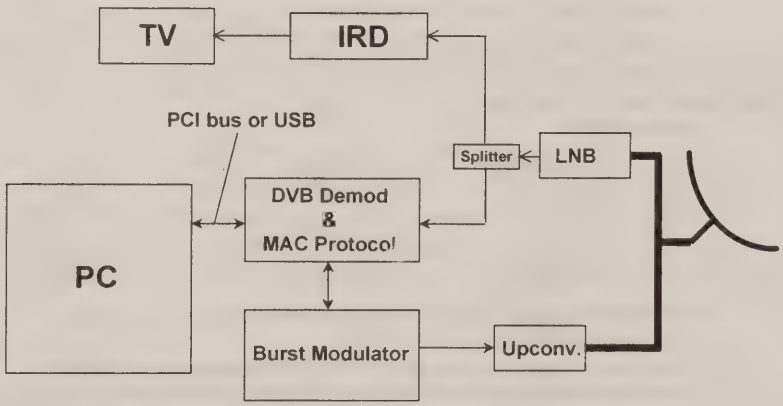
Interactive Multimedia Client Terminal Block Diagram



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Example of French Polynesia

- Representatives of French Polynesia saw the Ku-Band interactive terminal demo at INTELSAT in early 1999
- Requested feasibility study of implementing a network to distribute video and Internet using the DVB-IP platform
- Study given to them in April 1999

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Example of French Polynesia

- Implemented DTH video using the DVB-IP platform in June 2000
- Some service parameters are as follows
  - Carrier size is 41.47 Mbit/s
  - 72 MHz transponder in Ku Band on IS-701 @ 180° E
  - Receive antenna 0.9m and 1.2m (customers at Beam Edge)
- Possibility to extend the service for Internet access in the future.

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Questions?

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